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REPORT

OF THE

NINTH ANNUAL MEETING

OF THE

AMERICAN ASSOCIATION

FOR THE

Advancement of Physical Education,

HELD AT

YALE GYMNASIUM, NEW HAVEN, CONN.,
APRIL 5, 6 AND 7, 1894.

NEW HAVEN, CONN.:
PRESS OF CLARENCE H. RYDER.
1894.

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ANNUAL REPORT OF TREASURER,

American Association for the Advancement of Physical Education,

FROM LAST REPORT, APRIL 7, 1892, TO JULY 15, 1893.

RECEIPTS.

Balance in treasury—nothing.		
Dues collected for year ending April 1, 1893,		$406 00
Back dues,		31 00
Dues for applicants for membership,		12 00
Dues for year ending April 1, 1894,		7 00
Sale of Proceedings,		13 00
Donation from Mrs. Hemingway,		50 00
		$519 00

DISBURSEMENTS.

Stationer		$1 50	
B. S. Eldridge, account books,		2 50	
F. F. Thomas, envelopes and printing.		9 00	
Dr. E. Hitchcock, Jr., traveling expenses and sundries,		23 54	
Dr. E. M. Hartwell for:—			
S. A. Lubker, addressing and mailing,	$2 50		
Type-writing, etc.,	1 00		
Postage,	11 19		
Geo. H. Ellis, printing,	47 40		
Geo. H. Ellis, printing,	13 90		
		75 99	
Andrus & Church, printing, etc.,		118 65	
Mrs. Isabel Barrows, reporting, traveling, etc.,		43 75	
Graves & Henry, printing,		1 00	
Postage,		30 41	
			$306 34
Balance in treasury,			$212 66

(RECEIVED)

ANNUAL REPORT OF TREASURER

FOR THE

American Association for the Advancement of Physical Education,

FROM DATE OF LAST REPORT, JULY 15, 1893, TO MARCH 30, 1894.

RECEIPTS.

Balance in treasury,	$212 66
Dues and sale of proceedings,	367 00
	$579 66

DISBURSEMENTS.

1893.			
August	29, Secretary for postage,	$65 83	
	29, Morgan Envelope Co., stationery,	6 14	
Sept.	9, Graves & Henry, printing, etc.,	18 00	
	15, President, postage and mailing announcements,	9 45	
	30, Secretary, traveling expenses,	50 00	
	30, Glendower hotel, room for council meeting,	1 00	
Oct.	30, Frank P. Thomas, printing,	8 50	
Nov.	7, Secretary, printing stationery,	15 34	
	7, Treasurer, postage,	16 50	
1894.			
March	28, Treasurer, postage,	1 00	
	30, Springfield Printing & Binding Co., on account,	385 00	
	Balance in treasury,	2 90	
			$579 66

REPORT

OF THE

NINTH ANNUAL MEETING.

The Association was called to order, and the meeting opened by President Sargent, April 5th, at ten o'clock A. M. in the Yale Gymnasium, under the auspices of the Department of Physical Education of Yale University, and the following programme of literary exercises carried out:

Thursday, April 5th.

MORNING SESSION.

YALE GYMNASIUM.

10 o'clock. DEPARTMENT OF ANTHROPOMETRY AND VITAL STATISTICS.

COMMITTEE.

Dr. Edward Hitchcock, Sen., Miss Senda Berenson, Dr. Jay W. Seaver.

Subjects, open for Brief Discussions:

1. Critical Study of Demeny's Vital Index, Dr. Enebuske.
2. Tests of Special Senses and their Relation to Personal Hygiene.
3. Relation of Photography to Anthropometry.
4. Psychological Tests to determine the Value of Gymnastic Training.
5. New Apparatus for Measurements, with the Appliances on Exhibition.
6. Report on Progress of Anthropometry.

AFTERNOON SESSION.

DWIGHT HALL.

2:30 o'clock. GENERAL TOPICS.

"Some Relations between Physical and Mental Training."
PRESIDENT G. STANLEY HALL, Ph., D., LL. D., Clark University.

"Relation of Certain Exercises to Pulse Rate."
W. G. ANDERSON, M. D., Yale University.

"Reaction Time and Time-Memory in Gymnastic Exercise."
E. W. SCRIPTURE, Ph. D., Yale University.

"The Importance of Maintaining the Pelvis in its Normal Obliquity"—"A New Pelvic Obliquimetre."
ELIZA A. MOSHER, M. D., Brooklyn, N. Y.

"Study of Types of Respiration."
GEORGE W. FITZ, M. D., Harvard University.

"A Few Figures on Occupation and Exercise."
ALICE B. FOSTER, M. D., Chicago University.

EVENING SESSION.

YALE GYMNASIUM.

8 o'clock. GYMNASTIC EXHIBITION, classes from Anderson Gymnasium and New Haven Turn Verein.

Friday, April 6th.

MORNING SESSION.

DWIGHT HALL.

10 o'clock. DEPARTMENT OF HISTORY AND BIBLIOGRAPHY OF PHYSICAL TRAINING.

COMMITTEE.

Dr. E. M. Hartwell, Dr. T. D. Wood, Dr. Carolyn Ladd Hall.

Subjects, open for Brief Discussions:

1. "For what reasons and to what extent should a study of the History and Literature of Physical Training constitute a part of the Professional Training of Teachers of Gymnastics?"

2. "What can the Association do to develop an intelligent interest in the History and Literature of Physical Training?"

3. "Which would be more serviceable, in the immediate future, a classified list of the leading books and articles on Physical Training, or a complete Bibliography of the same? What topics should be included therein?"

4. "What steps are necessary to provide the members of the Association with a Bibliography of Current Literature on Physical Education year by year? Is it possible for the Association to undertake the work?"

5. "Is it desirable and possible for the Association to attempt to establish a Circulating Library of the Current and Classical Literature on Physical Training for the benefit of its members? If it is, what measures shall be taken toward its accomplishment?"

11:30 o'clock. DEPARTMENT OF THEORY AND PRACTICE.

COMMITTEE.

Dr. H. E. Arnold, Dr. Mary T. Bissell, Mr. J. Naismith.

Subjects, open for Brief Discussions:

1. Progressive Arrangement of Apparatus Work.
2. Gymnastic Play and Games in Educational Gymnastics.
3. At what Age should Children begin Gymnastic Drills?

AFTERNOON SESSION.

DWIGHT HALL.

2:30 o'clock. GENERAL TOPICS.

"Some Remarks on Physical Training as an Educational Discipline."

E. M. HARTWELL, M. D., Boston, Mass.

"Should Physical Education in Colleges be Compulsory?"

HARRIET ISABELL BALLINTINE, Vassar College.

"Therapeutic Value of Exercises."

RANDOLPH FARIES, M. D., University of Pennsylvania.

"Treatment of Lateral Curvature by Gymnastics and Massage."

DELPHINE HANNA, M. D., Oberlin College.

"Open-Air Gymnasiums."

ELIZABETH CAMPBELL MACMARTIN, Charlesbank Gymnasium.

EVENING SESSION.

NORTH SHEFFIELD HALL.

8 o'clock. "Physical Development of College Students."

D. A. SARGENT, M. D., Harvard University.

(Popular lecture, with lantern views of the Statues of the Typical American Student, male and female, and different types of physique developed by athletics and gymnastics.)

At the Friday morning session at Dwight Hall, Dr. Hartwell in the chair, an address was made by Dr. Hartwell on literature concerning physical education. Remarks were made by members present.

At this session, on motion of Dr. Gulick, it was voted that a committee of two be appointed by the chair, to serve with himself, as a committee of three, to prepare a classification of the subject of physical training, suitable for use in libraries in connection with the Dewey Decimal System, and to confer with Dr. Dewey on the subject. Dr. Claes Enebuske and Dr. A. D. Halstead were appointed by the chair.

The evening session was held in North Sheffield Hall, where Dr. Sargent delivered an entertaining and highly instructive paper, which was amply illustrated by lantern views of both classical and modern athletes. The Council regrets that this paper cannot be reproduced among our pages, because of the extensive illustrations that would be required to do it even scant justice.

Among other valuable features of the paper, was a presentation of a Greek module, that was probably used by artists during the developmental period of pure art in Greece.

In this connection, it might be well to state, that for the same reason, many photographs used in illustrating other papers read, were omitted, namely Mr. Phillips' of New York, and Dr. Seerley's of Springfield.

Business meeting held at Dwight Hall, Saturday, April 7th, at 10:30 A. M., President Sargent in the chair:

After the annual address by the President, remarks were made by Dr. J. G. Smith, Miss A. M. Homans, Mrs. C. E. Ehinger, Miss H. M. Clark and Dr. Sargent, who made pledges of money, in the name of their respective schools, to be used as a sinking fund by the Association to enable it to do a larger work. Individual pledges were also made to relieve the debt of the Association.

The report of the committee to consider district organizations, as prepared by Dr. Hartwell, was read by Mr. Christian Eberhard, as printed in the following:

Report of Committee on Proposed Changes in Organization of the A. A. A. P. E.

Your committee, believing that the interests of physical education will be best subserved by increasing the number of active local organizations in various parts of the country, beg to recommend the following steps, to wit:

That the A. A. A. P. E. authorize the Council to write out a detailed scheme, to be voted on at the next meeting of the Association,—which scheme shall provide for the organization of the Association into sections, districts, and societies for the advancement of physical education for general purposes set forth in the revised constitution of the A. A. A. P. E.

The Association shall embrace nine (9) sections, viz.:

New England, with headquarters in Boston.

New York, with headquarters in New York city.

Middle States, including New Jersey, Pennsylvania, Maryland, and District of Columbia, with headquarters at Philadelphia.

Ohio Valley, with headquarters at Cincinnati.

Mississippi Valley, with headquarters at Chicago.

Northwestern, with headquarters at St. Paul.

Western, with headquarters at Denver.

Southern, with headquarters at St. Louis.

Pacific Coast, with headquarters at San Francisco.

Each section shall include such district or State Associations as shall be designated by the Council. The District Associations shall consist of all the societies in a given state. The headquarters of each district shall be chosen by vote of the respective societies constituting a district. There shall be a Sectional Council chosen by the District Associations, constituting the section, to prepare for sectional meetings and to attend to the general business of the section. A National Council shall be chosen by the A. A. A. P. E. to maintain the National Headquarters during the interval between the meetings of the A. A. A. P. E. In the first instance, however, the National Headquarters shall be Boston, Mass., and the Executive Committee of the New England section shall constitute the first National Council.

Each section, district and society shall have an Executive Committee which shall have general regulation and control of the affairs of said sections, districts and societies, under rules and by-laws, which shall conform to the general principles and constitution of the A. A. A. P. E.

National meetings of the A. A. A. P. E. shall take place not oftener than once in two,—and at least as often as once in four years,—at the discretion of the National Council, which shall be empowered to set the time and place, and to arrange the program for said National meetings.

Each section shall hold an annual meeting at such time and place as its Executive Commitee shall appoint. The time and place of district

and society meetings shall be left to the discretion of the various district and society Executive Committees respectively.

The present Council, in preparing a detailed scheme to be voted on at the next meeting of the A. A. A. P. E., shall follow—in the main—the general plan of organization of the N. A. T.

Respectfully submitted,

(Signed) EDWARD M. HARTWELL.

New Haven, April 7, 1894.

This report was accepted and the Council instructed to prepare all necessary details for such organization, to be presented at the next annual meeting.

The Secretary was instructed to prepare a suitable memorial, relative to Mrs. Mary Hemenway.

Dr. G. Stanley Hall of Clark University, Worcester, Mass., and Mr. Augustus Hemenway of Boston, Mass., were unanimously elected to honorary membership.

A vote of thanks was extended to Yale University and the local committee, for courtesies extended at this meeting.

The minority report of the committee, relative to an official organ, was presented by Dr. Seaver, in the absence of Baron Possé, and was laid upon the table.

A vote upon the amendment to the Constitution relative to an initiation fee, previously proposed by Dr. Seaver, was lost.

The following amendments to the Constitution were proposed by Dr. Fitz for action at the next meeting:

Article I. to read: This body shall be called the "Physical Education Association."

Article IV. to read: "Constitute the Council," the Secretary and Treasurer to be employed by the Council.

Article VII., Section 2: Change "for two successive years" to "within a reasonable time."

It being understood that the Council will incorporate these with the other amendments necessary to make the Constitution conform to the new scheme of re-organization.

The report of the Treasurer, Dr. Ehinger, was read and accepted, and ordered on file.

The report of the Secretary, Dr. Gulick, was read and accepted.

New members to the number of 106 were then elected.

The following list of officers were elected for the ensuing year.

President,

J. W. SEAVER, M. A., M. D.

Vice-Presidents,

J. G. SMITH, M. D.,
AMY MORRIS HOMANS,
R. TAIT McKENZIE, M. D.

Secretary,

EDWIN P. LYON.

Treasurer,

C. E. EHINGER, M. D.

Council, with above,

EDWARD HITCHCOCK, M. D.,
ELIZA M. MOSHER, M. D.,
H. E. ARNOLD, M. D.,
E. M. HARTWELL, Ph. D., M. D.,
D. A. SARGENT, M. A., M. D.

TESTS OF SPECIAL SENSES AND THEIR RELATION TO PERSONAL HYGIENE.

By H. H. Seelye, A. M., M. D., Amherst, Mass.

For practical anthropometrical purposes the only special senses that need be considered in making such physical examinations as are attempted by those engaged in the different lines of work represented here to-day are the organs of sight and hearing. Had we time for such tests many interesting facts in regard to the variations and peculiarities of the senses of tasting, smelling and feeling might be elicited, but such information would probably be of little value to the one experimented on. Yet to whatever station in life the men or women belong who come to us for physical examination and instruction, it is of the greatest importance, in determining their fitness for the duties of life to which they feel themselves called, to know whether their vision, color-sense, and hearing power are normal or defective, and whether impairment of these senses is liable to be made worse by the kind of use to which they will probably be subjected. Thus, it would hardly be advisable for a color-blind man to set out to be a pilot at sea, or a railroad engineer, or an artist, or even a house painter, or a traveling agent, or clerk for a wholesale ribbon dealer, or to follow any calling where success would depend more or less on his ability to quickly distinguish the primary colors and their various shades. Neither would it be well for a youth who early shows defective distant vision, due to progressive myopia or near-sightedness, to undertake such callings as require either close application to very near objects, or accurate delineation of appearances far removed. Watch-making or repairing, fine engraving and steady microscopical work, as well as gunnery or rifle practice, lookout on a ship or an engine, military or police service, are some of the callings that would come under this head. One who is very far-sighted, i. e., hypermetropic, or who is astigmatic, i. e., more myopic or hypermetropic in one curvature of the eye than in others, unless these errors of refraction are corrected by proper glasses, would find difficult or impossible those employments which require continued application to very

near work, such as writing or book-keeping, type-writing or type-setting, or continued reading, especially in German or Greek characters, and similar occupations.

Though any of these defects of vision if present to a considerable degree will prove an inconvenience to its possessor, yet with the exception of the color-sense, they may all be so far ameliorated by the wearing of well-fitted glasses that a great amount of comfort may be obtained, while many otherwise difficult tasks will be made comparatively easy. So, while it does not seem to be the appropriate function of every one engaged in anthropometrical work to attempt to skillfully treat or accurately test the degree of visual defect in those subjected to the ordinary physical examinations, yet it does seem proper that each examiner should seek to discover in a simple, though somewhat crude way, whether or not any marked deficiency exists, so that the subject may be warned or advised in certain cases to consult a skilled oculist, before he has so injured his eyes by overwork or improper use as to be permanently disabled. With such an object in view the writer of this paper devised the short and easy method for testing the vision, color-sense and hearing, which is now included in the report of the committee appointed a few years ago (1886) by this Association to prepare directions for carrying out a complete and uniform system of anthropometry. Though making no pretense to thoroughness or accuracy of result, these tests may be easily made with inexpensive apparatus, and require but a brief experience on the part of the examiner to enable him to discover any marked defects, and to give advice as to the importance or otherwise of having them corrected. The frequency of visual defects in some degree is astonishing to one who has given but little thought to such matters. There is small doubt that the conditions of life and the requirements of modern civilization are fast producing a race in which what is commonly known as a "normal eye" is really becoming an abnormality. Indeed, if the eye with so-called normal vision was ever the perfect type, it can no longer claim to be so, if we determine the perfect ideal by the average results of numerous tests, as we are wont to do in plotting other anthropometrical data. In the optical examinations of the students in Amherst College for the past ten years we only find

about 30 per cent of such eyes, where neither myopia or hypermetropia exist in appreciable amount, while similar results have been obtained by other examiners. It would, therefore, seem more appropriate to call the "normal eye" that which is most commonly found among healthy young people living outside of the confining requirements of a studious indoor city life. Taking the average results of such examinations as a criterion, we find that nature seems to intend the normal eye to be, not emmetropic, with distant objects focusing directly on the retina, but hypermetropic or far-sighted. This is found to be the almost universal condition among those living out of doors largely, in a state of nature, as among savage, half civilized, or country people, where the eyes are being constantly fixed on more or less remote objects. While among those dwelling in closely built cities, where lofty buildings rarely permit a distant view, and where books, newspapers, and literary work, together with all the confining indoor employments, keep the gaze so steadily fixed on objects near the person, the muscles of accommodation are kept so constantly in a state of tension, that the crystalline lens gradually assumes a more convex shape, and from lack of relaxation the muscles become stiffened or spasmodically contracted, while the elasticity of the capsule of the lens diminishes, till at length a condition tending to myopia is steadily being developed. Thus a slight hypermetropia soon becomes an emmetropia, and this in time a myopia, if the conditions of tension are continuously kept up. Emmetropia then, instead of being the normal type of vision, may be regarded as only a stage in the process of the evolution of the eye from the higher hypermetropic to the lower myopic type. That this tendency toward near-sightedness is a modern defect, and brought about chiefly by the greatly increased use of books and papers, and by the arts and refinements of this age, is likewise shown by the lack of historical evidence of any such defect being common in the days of antiquity, before the invention of the printing press, by its greater frequency among scholarly people, and in countries where book learning is most valued, and by the fact, brought out by recent statistics in our institutions of learning, that the student's eyes are wont to approach more and more toward this condition with each advancing year of the course.

An examiner of eyes will not have advanced far in making tests before the curious fact will be brought to his notice, that, as often as not, there is, or appears to be, a difference of visual power in the two eyes of the same individual. Sometimes one will seem to have perfectly normal vision, while the other is markedly near or far-sighted, or one may be myopic and the other hypermetropic, or one astigmatic and the other not, or each may have the same defect, but in quite a different degree. Many having such variations are never conscious of the difference in the two eyes till their attention is called to the fact, while ever after, the most defective eye may make itself constantly conspicuous for its lack of power. When an oculist comes to prescribe glasses for such an individual, except in cases of astigmatism, he rarely tries to fit each eye separately, but puts the proper lens for the best eye on both, and lets the worst one adapt itself to that power as best it may. Experience has shown that eyes so long accustomed to work together with a different focus will continue to do better service if treated in this way.

Having satisfied ourselves with such examinations of the eye for errors of refraction, not omitting to take note at the same time of any other defects, such as loss of one eye, a difference in color of the iris, scars on the cornea, cloudiness or opacity of the lens, as in cataract, squint or deviation of one eye away from an object gazed at, redness or inflammation of the conjunctiva or membrane covering the outside of the eye ball, reddened or inflamed eyelids and such like, the next duty is to test the sensibility to colors. By following the directions laid down in the book of instructions there will be no great difficulty in this, and extensive experience will soon accustom the examiner to a ready detection of this defect. While the degrees of color deficiency may be classed as complete color-blindness, partial color-blindness and feeble color-sense, there will sometimes be found cases difficult to classify. All so-called completely color-blind persons are not equally so, and each individual will behave differently from most others with the tests. Those with feeble color-sense will at times so nearly approach the normal or the partially color-blind, that it is often merely a question of grade not easily determined. This defect is organic and never disappears,

though from a knowledge of its existence and long experience in comparing the doubtful hues with known shades of colors, the individual may to a certain extent guard against deception or conceal the deficiency from an inexperinced observer.

The above considerations of ocular defects have paved the way for a better understanding of the relations of personal hygiene to the use and preservation of the sight. It should not be forgotten that the eye is a more or less perfect piece of mechanism, which is during the waking hours kept in almost constant motion, by muscles which rapidly expand and contract as the eye is momentarily fixed on one or another object, more or less remote, and at various changing angles with the front of the face. Like any other muscles, those of accommodation will tire and ache when over-used or kept too continuously on a strain, or they will at length, by reason of exhaustion, fail to contract at the dictate of the will, or, from too great irritation, will be seized with cramps or spasmodic contractions, which may suddenly interfere with the act of vision, causing temporary failure of sight. And then alarm usually causes the patient to seek medical advise or to try the effects of rest from use. In either case improvement soon follows and a lesson is learned which is a warning to be heeded in the future. But when the visual defect remains uncorrected, and the eye strain is kept up in spite of such warnings, the evil effects at length are apt to manifest themselves in other ways, as in severe headaches, epileptic fits, hysterical seizures, nervous exhaustion, and general debility. The prevention and cure of these disorders must therefore lie in the adoption of such measures as will tone up and strengthen the whole body, and when glasses are not worn, the use of the eyes, especially for near work, should be limited as much as possible, and at the same time the glare of too strong light should be avoided, as well as the dimness of too feeble an illumination of the objects on which the eye must necessarily be more or less steadily fixed. The light on the book or other work should be clear and steady, not flickering or dull, and should radiate as nearly as possible from a point at the left and slightly above the level of the face. Thus, in writing or using tools, the shadows are prevented from obscuring the work, and no direct glare strikes the eyes. When

the vision begins to blur or the eyes to smart or ache, the work should be laid aside for a while and the eyes be bathed or splashed with cold water, to stimulate the fagged-out muscles. If, in spite of these precautions, the trouble persists or frequently recurs, it will be advisable to consult an oculist, who will probably prescribe such glasses as will help the accommodation and so relieve the muscles from the excessive work to which they have hitherto been accustomed. Whether or not such glasses will have to be worn permanently thereafter will depend on the degree of the error of refraction, and on the success in restoring the tone of the muscles, and on the improvement of the general physical health. Where the defect is a growing near-sightedness, pains and blurring of vision while reading or doing near work are rarely noticeable, but the patient's attention may be attracted to the fact that he does not see distant objects as clearly as he used to, he fails to make out the time on a clock as easily as his neighbor, and often passes his acquaintances on the street unrecognized. This may give him the reputation of being reserved or absent-minded by those unaware of his infirmity. At the first appearance of any such symptoms an optician should be consulted, who will fit the proper glasses to not only improve the clearness of vision but also to some extent retard the progress of the disorder. Myopia beginning in early youth, is, if neglected, apt to progressively increase up to the age of twenty one or twenty two, when it usually ceases to advance and remains stationary for the rest of life.

When the applicant for examination is approaching fifty years of age the effects of presbyopia, or old-sight, will generally become manifest. This defect is characterized by a more limited range of accommodation, due to a hardening of the lens and a diminution of the elasticity of its capsule. This becomes permanently less convex, and hence glasses with convex lenses are requisite to overcome the defect, which is most apparent in reading or doing near work. From inability to focus rays of light from so near a point, the object must be held at a constantly increasing distance from the eyes in order to get distinct vision. The myopic eye, being in youth an unusually convex one, is less apt to require the help of glasses as old age approaches, for the diminution of convexity in the lens is not so great as to

focus near objects behind the retina as in normal or far-sighted eyes. Such people may never need to wear glasses for reading after they are fifty years of age.

Passing on now from the eyes to the ears, the function of *hearing* as related to our tests requires a brief consideration. Except in the case of army and navy recruits and railroad employees, little has been done in compiling statistics of the average hearing power in healthy communities. But for several years past all the students entering Amherst College have been so tested, and the results have been a surprise. We have found that about one in every five examined showed some defect in the hearing of one or both ears, and very few of these were ever conscious of any such deficiency until so informed. Often one ear is found to be perfect while the other is not, or, there is inability to distinguish sharp or high-pitched sounds, while the voice and most ordinary noises are readily heard. In some cases there is such a confusion of sounds, or roarings in the ear, that talking and other clear-cut notes are more audible in riding in the cars or in noisy factories, where the constant rumbling of the wheels and machinery seems to deaden the less conspicuous roaring and buzzing always going on in the ears. Having then by the tests discovered any marked defect in either or both ears, the examiner should advise the sufferer to consult an aurist, who, in many cases, will find the cause to be an accumulation of hardened wax in the external auditory canal, or a catarrh of the throat, nose and Eustachian tubes, which, when properly treated, will usually result in a complete restoration of hearing. The hygienic management of the ears then, consists chiefly in maintaining cleanliness of the external canal, and the avoidance of taking cold, or, of such exposure as would tend to set up or aggravate an already present slight catarrh. Also the avoidance of the vicinity of loud explosions, or the constant thundering of water or machinery, which gradually deadens the ear to the detection of more feeble sounds. Acuteness of hearing is largely a matter of attention. The savage forms the habit of noticing every little unusual noise which might indicate the presence of an enemy or the neighborhood of game, on which his living depends, and his ear becomes most sensitive to feeble sounds, while the dweller in the city is so constantly environed by the

hundreds of different notes confused together in a general hum, that his hearing at last becomes deadened and insensitive to such noises, and they make little or no impression upon him.

Did the limited time allotted to this subject permit, many other profitable points for discussion might be suggested, such as the influence on these organs of tobacco, alcohol or other narcotic drugs, the over indulgence of the animal appetites, long exposure to very bright lights, whether electric or from the sun direct or reflected, or modifications produced by diseases in other parts of the body, etc., but if what has already been said will excite a greater interest among physical examiners in detecting and correcting some of the preventible defects of the organs of special sense, the object of this paper will not fail to be accomplished.

REMARKS BY MISS BANCROFT, of the Brooklyn Public Schools: While this matter of the special senses is being discussed, I would like to put in a word for the cultivation of these special senses in our public schoolrooms, particularly in the hygienic environment of the children. I think that the conditions are very disadvantageous many times, particularly as regards the straining of the eye by the constant dullness of color, many of our schoolrooms being black and white and gray totally. It is only in the newer buildings that we have the light woodwork, and then in straight lines. There is very little decoration in the schoolrooms that would give the rest that comes from curves; and, as regards color and outline of objects around the children so many hours of the day, it seems to me that the eye is subjected to a strain that is deleterious to its cultivation as a sense organ. This is just a suggestion.

PHOTOGRAPHY IN ANTHROPOMETRY.

PAUL C. PHILLIPS, NEW YORK CITY.

The object of anthropometry in physical education may be defined as twofold. First and foremost, to furnish data which will be helpful in the treatment of the individual measured, and secondarily to add to the statistics from which we learn what is the ideal human form and how best we may work for it.

Photography finds its chief value in anthropometry as an aid to the former one of these objects, furnishing helpful facts for the individual case. It is especially useful in cases of asymmetry and abnormality.

The difficulty of satisfactorily measuring bodily defects which are quite apparent to the eye, or of adequately expressing them in figures and words, once they are taken, has doubtless thrust itself upon all who have dealt much with anthropometry.

The errors to which even the trained eye is liable, in testing the symmetry of the subject, are too evident to need further mention.

The amount of time necessary for extra measurements and tabulation in these cases, in view of their insufficiency at best, has, I fear, deterred many of us from making an attempt. Yet we knew that something more than the usual measurements were needed.

By the anthropometric chart we can see the individual's lack of symmetry only at certain places and masked by his relation to the rest of mankind. Attempts have been made to represent these cases graphically by such instruments as the cyrtometer, thoracometer and pantograph, but all these, so far as we know, are restricted to outline delineations and that generally for limited regions. Their usefulness in furnishing outlines of body sections is unquestioned, but for depicting both outline and contained superficies they are not adapted. Yet no argument is needed for the statement that a hundred sections of the body will not convey so good an idea of its form as two fair photographs.

What we want to help out the usual measurements of the unsymmetrical man is something which shall show how he looks, *put together*, as near as may be *in the solid*. With this on our measurement blank its figures and history will receive new meaning. With the subject always before us our prescriptions will be more intelligent, while succeeding photographs may pass judgment on their efficacy.

The camera seems, at present, to be the nearest response to this need. With the necessary apparatus it can be made to show deviations of half an inch from symmetry. One photograph from behind may show a low right shoulder, projecting

scapulæ, a short left leg, a scoliosis, a tendency to kyphosis and everted or projecting ribs, besides points of minor interest in the muscular apparatus.

But the camera helps us in another way. Granting that our object in measurement is to benefit the subject, any means which will show him his defects in a way which shall stimulate him to overcome them is a useful adjunct to anthropometry. Bare figures do this in a degree, the graphic chart does it far better, but nothing will be found to impress him so profoundly and cause so earnest an endeavor to mend himself as a picture of his own imperfect body. Nor does anything, as far as anthropometry goes, give the faithful pupil quite the satisfaction derived from a photo-comparison of his new self with what he once was.

How, then, may the camera be made to show the variations which have been noted? It is evidently impossible without some additional contrivance. Attempts have been made to assist the eye by drawing lines on the photograph, once taken. These, however, were subject to so many chances of error that, while helpful, they could not be considered trustworthy. They indicated that guiding lines were needed in the photograph to which a man might be squared. The question was how to provide them.

The writer, during the past year or two, has tried a number of schemes with varying success. Thus far the two most useful and practicable are the blackboard with ruled lines, and the frame of wires or cords.

The first method consists of a blackboard of perfectly plane surface of a size to reach from the knees to the head, and laterally to include the shoulders. This is placed vertically in the examining-room. On it are painted in white, fine, parallel, vertical and horizontal lines, exactly an inch apart. The horizontal lines are numbered consecutively on each side from the base up, and the vertical ones from the median line out. At right angles to this board and at such a distance as to include it on the ground glass, the camera is placed. The unsymmetrical subject is stationed as near as may be to the blackboard and a front, rear or profile view taken.

His picture is thus projected in sharp outline against its black surface, and by means of its ruled lines his lack of symmetry—and roughly the measurement of it—may be read off.

If the view is taken from behind, major defects in the antero-posterior direction may be noted by the shading; for minor ones a profile view may be added. The inaccuracy of this method lies in the fact that one cannot get the subject close enough to the board to avoid errors in the projected lines, and secondly, in the fact of their not being superimposed, (except on the outlines), so as to come into direct relation with the points to be tested. It has the advantage of ease in construction and as a corrective to the eye in making examinations, without camera, is useful.

The other method, to which we are indebted to a Frenchman, I believe, is the frame of cords or wires. I am not aware how he has arranged these, but will venture to describe the means used at the Young Men's Institute. It consistss imply of a frame of wood, 6 x 3 feet, with fine parallel cords stretched tightly across it in both a vertical and horizontal direction. These are an inch apart and are numbered as the blackboard lines. The whole is suspended from the ceiling so as to hang vertically, this point being gained by plumb-bob and level, inserted into the frame. In using this screen, the subject is placed behind the cords, and a dull-black cloth hung for a background. The advantages of this device are its greater accuracy and the fact that the lines cross the body. Its disadvantages, if you may call them such, are the difficulty in construction and a slight shading of the subject by the lines or cords.

In using either method better results will be obtained by marking some of the bony points on the body with an aniline pencil, viz., the vertebræ, acromia, crests of ilia, tips of scapulæ, etc. Care must be taken in this not to mark the integument when misplaced.

By observing the proper precautions regarding location of camera, subject, and screen or blackboard, variations of 1-4 or 1-2 an inch may be detected in the two sides. We may also roughly measure the height of shoulders, hips and knees, and width of shoulders and hips, thus getting a good general idea of

his bony make-up. The contour and shading will tell much of his muscular development.

For comparative measurements the results are better if the camera is placed in exactly the same position each time. If this is done, "over prints" may be made to show the difference in outline.

Regarding printing, of course any kind of paper may be used. Blue prints are the cheapest but bromides give the best results.

There are many lines along which photography may be developed in anthropometry. By numerous photographs taken from one spot a "combination photograph" or an approximation to the normal man may be made. By additional figures at the side the subject may be enabled to compare himself with the rest of mankind. Slides may be prepared from the print to illustrate lectures, or double prints may be provided for use in a stereoscope.

I fear that some may not wish to attempt photography in their anthropometric work for fear it will cost so much in time and money, that it will not repay them for their trouble. Let me assure them that their fears are ill grounded. The cost of the whole plant, outside the camera, need not exceed five dollars, and once the plant is obtained, the expenses are trifling. With a 4 x 5 plate the first photograph need cost but ten cents and the rest considerably less. As regards time, if your plant is right in your examining-room and in working order, that is, blackboard and screen in place and camera in position, loaded and focussed, no more time is required than a few strength tests. I have taken them in five minutes with the additional hindrance of a flash light. This leads me to say, by way of parenthesis, that the lack of daylight need deter no one from using this help, as flash-light pictures are moderately satisfactory.

The camera is not essential to the examining-room, it is not perfectly accurate, but it is useful, we claim, where many cases of asymmetry occur, and it is more accurate than anything yet devised for outlines and details combined.

In conclusion, we have tried to show briefly that photography deserves a place in anthropometry because of its value and practicability. This place it has not hitherto held. Let me, as one who has gone a little way, urge you to give photography a fair trial.

DR. HITCHCOCK: This paper is before you. Will anybody ask any questions or make any statements?

REMARKS BY MR. ARNOLD OF NEW HAVEN: For effective work, the camera should always be placed in the same position. If the same amount and the same quality of light can be had, that will shut out another error.

If we give the same position to the subject or object, we will shut out another source of error. The light, in a room adapted for that purpose, might be obtained especially well with a flash light; the errors would then be equal. To get the same position for the subject is quite a different and more difficult thing. I have found that in measurements on the same subjects the errors are considerable. It is a very hard thing to place a man or boy in a position and keep him there for any length of time. The slightest contraction of any muscle throws him out of the position, so that you can figure the difference in one quarter inches and even inches, etc., which makes quite a difference in schedules. It is a difficult thing, when measuring a man at different times, to make him assume always the same position. This is one of the main difficulties. Dr. Seaver has nearly the same contrivance that a photographer would use to fix a person's head. By that he keeps a man, once put there, in the same position. If this contrivance was graduated by inches or centimeters, and the position noted by some method, the next time we put the man in position we might give him exactly the same position as he had at previous sittings. I think this would be a great help, and make photography much more useful than it has been heretofore.

MR. JACKSON OF NEW BRUNSWICK: I have noticed in taking photographs that the light, the reflection, often caused an erroneous idea of the symmetrical portion of the subject. If you get before a good clear glass and have the light on one side, sometimes you are brought to believe that one shoulder is half an inch lower than the other, when really it is not so. Of course, I believe in photography, but this is one of the things that I have noticed myself.

DR. SARGENT: I want also to bear testimony to the fact that Mr. Jackson has just brought out. We have taken photo-

graphs at Cambridge for the last five years, taking the men in three different positions. I am fully willing to admit that, as what we might call corroborative testimony to the facts, it is very valuable, more especially in interesting the student in himself. He cannot always understand the chart, nor does he know the significance of the figures. To tell a man that his neck or chest measures so many centimeters does not give him any idea. All of us have our favorite photographer: some of them make us look a great deal better than we do. There is a great deal that is deceptive in regard to photography, although I thoroughly believe that it is very valuable as an adjunct to the work.

REMARKS BY DR. SEAVER: Just a word in regard to this matter of photography. I believe that we, many of us, make a vital error in our attempts to photograph a case of scoliosis, by failing to outline in black, or some strongly marked color, the spinous processes. You take a perfectly normal back, and if your light is shining just right you will get a shadow on one side and an apparent curvature that you cannot measure by a rule applied to the photograph. Now, on the other hand, if you will mark with the tip of your finger or a little brush the spinous processes black before you photograph the case, you will have your outline. If you get the plane of the body at right angles to the focal direction of your instrument, you will get an indication of the amount of curvature that I believe to be fairly correct. I have used the cross lines, the perpendicular lines especially, having a line suspended from above so that it falls down at the central part of the occiput and placing the person in position so that it falls through the center of the pelvis. Or, in cases that are very marked, where the occiput is evidently tilted for the sake of the balance of the man, I let the line pass through the seventh cervical spinous process, instead of through the occipital center. I believe that is a pair of valuable points to remember, —the center of the pelvis for the bottom of the string, the seventh spinous process for the upper part, or the occipital center.

Now, with your permission, Mr. President, I wish to refer to our first paper, because I am afraid it will be lost, and I believe it is too good to be lost in the discussion. I am especially interested in that, because it is work that I am doing. I believe that the matter of examining the special senses of an individual

is quite as important as taking the sizes of an individual's parts. We are most of us dealing with the student class in the community, or at least we are dealing with young people, both men and women. It is very important that we do not look upon ourselves simply as gymnasts. We are to stand between the young individual and future difficulties, so far as we can. So far as we fail to do this, we fail in our work. Now we must not look upon this work of ours as simply a matter of getting more brawn, more muscle. We must look out for the more delicate parts, I believe, with even greater anxiety and care than we do for muscle. The most important thing that we are to do, if we are handling students, I believe, is to find out whether their eyes, those little organs by which we gain nine-tenths of all the information that we get in this world, are normal or not. If we find that they are not normal we can refer that person to a specialist, whose business it is to know what that particular organ needs. I do not say that it is our business to prescribe glasses for every abnormal case of vision, but we are to stand between that person and an entire breakdown of the physical sense, that will bar his progress as a student, by making him know early that there is something wrong. Then we shift the responsibility from our own shoulders on to some one else.

If it were a question, in handling students, of taking their measurements and omitting an examination of the eyes, or making an examination of the eyes and letting the measurements go, I would say let the measurements go every time. I may be radical on this matter, but our measurements are simply a record of an individual's size when we find him. It is not what helps us to prescribe exercise for him; our visual observation and judgment does that. We never look at the book to see what particular exercise to prescribe; we look at the person. You see then what I mean by the measurements being comparatively unimportant.

If we find a student with abnormal vision and we notify him that there is something wrong, we often give him a great surprise, for he has considered himself perfectly normal. In some cases there will be a difference between the focal or visual distance of the two eyes, and we all know that a difference of the two organs means that if we have the object at the right distance for one eye the other is getting a blurred impression on the

retina; this causes a constant strain to clear the imperfect image. The only reason why more of these young men do not break down is because of their superb vitality and their unconsciousness of having any such thing as a nervous system. It will come later in life, when they get into professional life, where they are not getting the regular exercise and do not have the hygienic surroundings that they have in college.

The statistics of visual errors of refraction are of some interest as showing the prevalence of abnormalities. Among 510 men recently examined for the first time—

(1) 9% were wearing glasses for defective vision.
(2) 19% were myopic to an extent of 20–30.
(3) 14% were hyperopic.
(4) 35% were astigmatic.

The fourth group includes many of the second and third groups. Group (3) would undoubtedly be larger if small amounts of error were recorded.

At Amherst, Dr. Derby found 15% of the men were hyperopic and 35% myopic, while only 50% had normal vision. Tscherning found among 491 students in New York only 63% with normal vision, while Mathewson examining 549 students in New York found 29% myopic, 14% hyperopic and 57% normal.

In regard to another point; that is, the importance of this sense of hearing. Many a child has been voted dull by the teacher because he could not hear acutely. One of the best teachers we have here in Yale told me within two years that he had in recent years learned to be a great deal more charitable in his judgment of men because there was a student in his class whom he was acquainted with outside of the recitation-room, and he knew him to be a good, thorough, honest, able young man, but in recitation he did poorly. He made a special inquiry into the young man's sense of hearing, and found that he did not have one-third of the normal acuteness of that particular sense. There was an excuse for the low stand that he had, and an explanation of many failures. Now if we can stand between the young man or the young woman and complete deafness, or remedy a partial deafness by referring that person to an appropriate specialist, we shall be doing more for them than we can possibly do by putting them through even a dumb-bell drill.

THE RELATION OF PHOTOGRAPHY TO ATHLETICS.

F. N. SEERLEY, M. D., SPRINGFIELD, MASS.

Photography and athletics have grown up side by side, but have not associated with each other to any great extent. The professional photographer has been allowed to make a few plates at the field contests, but his idea was to simply get that which he might sell, regardless of its inherent value.

A few snap shots have been made here and there by some one interested in some special shutter, lens or plate, and used later as an advertisement. A few have been made to show some prominent athlete's form in doing a certain event, but to combine the two arts in a systematic way has received but little attention on the part of men devoting their time to athletic work. In other words, the professional photographer has done his work for money, and the average amateur has done his work for fun, "You simply push the button and we'll do the rest" being the natural outcome.

This kind of work is all right in its place, but is of little value in solving scientific problems.

Believing that this ought not so to be, we are led to inquire into the relation which ought to exist. We may not hope to treat the subject exhaustively, but will attempt to make the paper at least suggestive.

No one will deny the value of illustration in teaching. It has become very prominent in all phases of education.

I heard a gentlemen once say that you often hear of a thing passing in at one ear and out at the other, but you never heard of a thing passing in at one eye and out at the other. Pictures impress the mind more than description, and we must recognize this in physical education, for the mind-picture must precede the act.

METHOD.

There are many methods of doing some of our athletic events. I suppose all of them are based upon principles, but it is evident that some have great advantages over others.

It may not be easy to demonstrate this by actually doing each, for the body moves very rapidly, and only an expert eye can detect what was done. But the camera can catch any stage of

the event, and show it as arrested movement. By means of this, a study of the different muscle groups involved may be made, as well as the relation of the different levers and their length. To illustrate this point, I call your attention to photographs showing five methods of starting for the hundred-yard dash. Here I show you the position of "set" and also the first stride of each.

The advantages and disadvantages of each method are evident after careful study, and we are greatly assisted in determining which we prefer. The photographs of the pole-vault will also illustrate this point.

FORM.

Having selected a method, the form is a very important matter. To show this it will be most convenient to analyze the event into its different parts. Suppose we select the pole vault. A natural analysis would be:

1. The run—showing the form of the stride, the length of the stride, and the method of carrying the pole.
2. Sticking the pole—showing "the reach," position of arms and distance from uprights to take off.
3. The rise—showing relation of body and pole, lift of the legs, position of arms at start and finish.
4. The turn—showing the change of position when the rise is completed.
5. The drop—showing the "shoot," pushing away the pole, etc.

I have only illustrated the rise, the turn, and the drop, but they will be sufficient. Also those of the high jump, shot put and hammer throw may be interesting to you. But even after a man knows what correct form is, he may not be able to do it. You explain to him where his mistake is, and yet he has but a hazy idea of what you mean. Take a photograph of his mistake, and he sees the point at once, especially when compared with the picture illustrating correct form. I present a few such.

One shows a bad position of the legs in the rise of the pole vault. Another shows the man away from the pole, and he has turned before he has reached the summit of the rise, a very common mistake among beginners.

INSTRUCTION.

I have already referred to one point in this connection, but from a student's standpoint, viz., showing a man where he makes a mistake, by the actual photograph. It is from a teacher's standpoint I now speak.

I have found it of great value in the application of animal mechanics to athletics. Men are continually getting into bad habits. They must be constantly reminded that these exercises are simply the application of the principles of levers to the body, and that the best method is that in which the largest number of levers are brought into use and in which they work to the greatest mechanical advantage. Hence, photography enables a man to teach principles rather than somebody's method, and as well, opens up the way for the study of athletics as nothing else does.

Our tendency as teachers is to observe the method of some one who has proven himself an expert, and to conclude that because he jumps an inch higher than another, his method must be superior. Some men are built to jump, and a poor method might still allow them to excel. We should teach and illustrate principles, and then men may deviate from this or that method, so as to apply these principles to their own build and make-up.

A study of my pictures of the high jump will serve to illustrate what I mean.

INTEREST.

Men must become interested before they will take up any form of bodily exercise, unless it is made compulsory.

A very small per cent. of our population have any real interest to-day. A few will pay $2.00 to see a foot-ball game, but a good salary would not induce them to take exercise themselves.

Photography serves to create new interest. Hang up your photographs in your gymnasium building, attach a card to them, stating who the athletes are, the year, their age, the record made, and any other points of interest. Make a set of lantern slides, and before the season opens, give some exhibitions, first, to members, to set them thinking and talking, and second, to the public, to attract their attention and create public interest. This may have much to do with the success of the season's work. It

might be very fortunate if the work on the grounds could be begun immediately after the revival of such an interest, for the public eye would naturally turn from the picture to the real, and thus not be lost.

JOURNALISM.

Not less important as a matter of attracting attention and creating public interest are the illustrated articles in the daily papers, as well as in the athletic reviews, *Harper's Weekly*, etc.

When these illustrations are made to represent something definite in athletics, like the series of wrestling pictures in *Harper's Weekly* some time ago, then they will not only serve to create interest as now, but will be educative in their nature. Knowledge is a most important element in making the newly created interest permanent. Hence, we should not be satisfied with simply amusing or entertaining the public, but should constantly strive to educate them.

Photography also makes it possible to put athletic work in book form, making it as truly valuable as those illustrating wrestling, boxing, fencing.

JUDGING.

Races are often seemingly a tie, and it is most difficult in many cases to determine who was the winner. A photograph of the finish will allay all strife, and the judges have positive and permanent record. Where large stakes are involved in horse-racing, nothing but a photographic plate will be relied upon. In our ordinary athletic work this, of course, would not be necessary, and yet controversies do arise. It would be very interesting, however, when publishing a newspaper report of the field day, to include cuts of the events in actual progress, and especially at the finish.

Another thing that would be useful. Make the picture correspond to a definite scale, say one tenth or one twentieth of life size. This would give a permanent record of the height of vault or jump, and when slides were made, the pictures could be thrown upon the screen in a uniform and life size.

Thus, we have tried to show that method, form, instruction, interest, journalism, judging and study may be promoted by photography in its relation to athletics, and we feel that it occupies an important place.

SOME RELATIONS BETWEEN PHYSICAL AND MENTAL TRAINING.

G. STANLEY HALL, PH. D., LL. D.

(This was delivered without notes, and is taken from the stenographer's report.)

My impression is this: that intellectual development ought always to be based upon physical, and that it is liable to be abnormal or unhealthy unless it is. In fact, this has become almost a cardinal axiom with me. In the first place, we ought always to give only one subject precedence to physical training, as it is generally understood, and that is the matter of regimen. We are very prone to forget that there is a nutritive and trophic background to every function and activity of life. If the brain or muscles are imperfectly nourished, if we have not the power to convert food into blood, if we have not the power to convert it into not merely so-so, but tolerably good human meat, we have not any right to educate the brain very much, and there is disaster liable, if not inevitable, if we do.

The first thing, then, is digestion—those processes, so infinitely complex, by which food is transmuted into brain. There is a vast difference in the power of men and women to make that transmutation. We ought to think on the basis of the most perfect human tissue that digestive apparatus can produce; but when you see flabby muscles, and bad complexions, and the other signs of dyspepsia or imperfect nutrition, it is certain to infect the thought. There is not a man or woman who would not do more for science, for literature and everything that is good, if they could make better blood and better tissue, and I think physiological chemistry is coming to show that the difference in blood is very great, so that the first thing of all which gives us justification for intellectual and for athletic training, I believe, is a good digestion. Of course, we cannot have the best without exercise, but what I am attempting to assert is, that digestion must be put in the foreground and other things subordinated, as means, until that is secured.

I do not believe it is possible to lay too great stress upon this. We know that a great majority of nervous diseases, and a

very large number of other diseases that are not known to be of neural origin, begin in imperfect nutrition. A great many begin in that kind of nutrition that affects chiefly the brain. There is every reason to believe that the molecule of the brain and nervous tissues raises matter to the very highest complexity of which it is capable of being raised; and God and nature designed that our thinking should be done upon that platform. That is the physical basis of science and literature, the highest degree of nutrition. Therefore, the regimen of sleep and food, —plain food, abundance of sleep, and a wholesome and unconstraining regimen, which is so difficult to achieve in this country, where everything is always fiddling on the nerves, where our cities are getting to be biological furnaces that burn us out to the socket,—that is the first postulate; and when you come to the harvest home of this great cause of physical education, that is to say, when the final verdict of the race is made up to date, I believe that the basis upon which judgment will be pronounced will be the standpoint of regimen.

Does physical training tend to make us habitually take more wholesome food, sleep better, and perform these other functions that may, perhaps, be called regimen, as distinct from physical training? That is the question. A distinguished doctor said a little while ago that if it was his duty to pick out the wife of the future king of England, he would first ask what she ate, what her habitual diet was, whether wholesome or fantastic, of the sweetmeat order, that laid great stress upon desserts; second, he would ask whether she slept well nights, and he would be very glad if she took a wholesome amount of physical exercise; but if all these were secured he would thank God for all other extras.

Of course physical exercise addresses itself to the great muscle tissues which make up half the average adult male body, I suppose, by weight; their culture is very important. The muscles have done all man's work in the world. They are especially the organs of will. You cannot have a firm will without firm muscles; and there is nothing so dangerous for morals as to have the gap between knowing what is right and proper and healthy and the doing of it, yawn; and it always yawns if the muscles get weak. If they are flabby it is a great

deal harder to do things. I believe that the temptations that assail young people nowadays are, to quite an extent, those that would not overcome them if their muscles were strong. They are of that insidious, corroding, undermining kind that are, somehow or other, so prone to creep in as the contractile tissues become relaxed and habitually flabby. So that I should place, as the second, muscle habits, because that is another criterion by which a nation is judged, in the long view. Those nations persist, survive, that have good muscle habits that exercise in a proper and normal way.

There is one subject that is fundamental, and yet often ignored. One of the most important bases for intellectual training is the muscle habits, because they give us what I call rhythm. Rhythm is a subject which it is hard to discuss, and one of the most hopeful signs of the laboratory has been that we have been able to control its complicated conditions to some extent and experiment upon it. It is an old saying, that the man who writes the songs for a nation does more for it than he who writes the laws. Plato's dictum was, that if he had any of these Lydian poets,—and if he lived now he would have said these writers of cheap opera music, that is exciting, stimulating, —he would crown them with fillets of wool and lead them to the boundary of his ideal republic and tell them not to come back. He would cultivate the Doric hymns, and perhaps the Phrygian hymns, as being perhaps more allied to the mood of the gymnasium.

See how one moves, walks and talks, and you will see a great deal about him. The habitual rhythm of motion, I believe, is fundamental for full intellectual development. I do not believe it is easy to overestimate the importance of it. There is a profound and close relationship between our muscle habits in that respect and thinking. Who of you would ever expect to see one of those light young fellows that you see on a chilly morning always standing on the street corners, perhaps doubly shuffling, with a large idea in his head? Take the girls who love a neurotic machine, which, I have been told, in Germany has been banished from the few retreats for insane patients in which it ever found entrance,—the American rocking-chair,— the instrument that increases that tendency that nervous people

always have when they get fidgety to move about, to get an accelerated rhythm. I wonder how much of a revolution it would make if we could banish the rocking-chair from America? One distinguished alienist says the American rocking-chair is the cause of Americanitis. We know, now, enough about the development of children and adolescents to know that the powers of activity are always developed before the powers of control. The powers of reflex action, of responding to things, come first, and later comes the power to resist this tendency—the power to inhibit, as we say. First, the powers that are spontaneous, then the power to control and rest. A great many people live and die undeveloped. They have no control; the last, highest story has not been put on. They have not, you may say figuratively, that last layer of the brain where association, which connects one part with another, crosses, and that is a thing of very slow rhythm. We are coming to believe now, in the study of physiological psychology, and it is no materialistic notion of the specialists, that, besides all its other functions, that serves a very important physiological function in this: it mediates in the brain; it is that which acts on fibers that have been called, perhaps prematurely, the association fibers, the distributers of energy in the brain. There are some parts of the brain that are liable to suffer from overpressure—there is more energy generated than they use. There are other parts of the brain, where men spend all their time doing some little thing, that suffer and decay; and it is, therefore, a point just as important for the economy of the brain that there should be thinking power in it as that there should be commercial exchange, clearing houses. This function mediates between the points of the brain that are overcharged with energy and those which are undercharged. It allows us to draw upon our resources; and if intellectual discipline had no other functions, education would be worth all it costs, and more too, because it is the generalizing function—it communicates between parts of the brain. Jean Paul Richter said he had seen a great many men who had in their brain charcoal, and saltpeter, and sulphur, which are the three ingredients of gunpowder, but they never made an atom of gunpowder in their lives, because these elements never got together—they had not been associated.

This is an aspect of things from which we are judging intellectual training, from your standpoint, the standpoint of athletics. Possibly a man who can do a little thinking can summon his physical and mental powers more readily, bring himself to a slow, long, hard, concentrative focus, so that all the resources in his brain can be heard from. He will not always suffer from after-thought, as some people do, but will bring all of himself to bear upon all things. It seems to me that the old Turner adage, "frisch, frei, fröhlich, fromm," points in that direction. Your ideal athlete is a man of heartiness and genuineness, with good, earnest, serious, large, steady thoughts.

We are finding from very careful study made this year on school children, one very important thing, and that is this: that physical training ought to be based on the child, like everything else. We have tried hundreds of school children, to have them make simple movements with the shoulders, hands, arms, fingers, and the result, I think you will all see when it is published, is amazing with regard to the inability of children. Previous child studies have shown an amazing amount of ignorance; this showed inability to make simple common movements, on the part of the children, from the time they enter school on. In more than sixty or seventy movements, we took the children and subjected them, with the utmost caution, to eliminate all sources of error that we were able, to these tests, and are now figuring up the results, and this in general appears very distinctly: that the power to move the hand well comes late. They can move the trunk, shoulders, hips, legs, but the power to make fine movements with the hand comes much later. And another result is this: that the child, in growing, passes through almost all the stages of motor diseases. In has been said, and it is pretty well accepted now among those who study from the physiological standpoint, that the child suffers all forms of speech diseases in learning to speak. But it seems also true that a child shows symptoms of about all the motor diseases in learning to walk and use its hands and arms. We are amazed to find that if we diagnosed severely we could convict almost every child, of some paretic or motor disorder, which, of course, most outgrow without a trace. That shows how very important motor education is in the schools, and we must go slowly.

And not only that, but the last thought is this: we must not invert the order of nature. The great crime of wrong education, the danger into which it is always falling at every point, cannot be better designated than by the word precocity. We are always inverting growth and letting children begin where adults ought to begin, and working down, instead of working the other way. I read lately that a committee of the British Association for the Advancement of Science found the science teaching was decreasing in the schools. Why, nobody knew; nobody knows now. But I believe one reason for it is this: that we begin with too modern methods. The country child not only has a totally different motor habit from the city child,—the city person's motion is limited at every point,—but the city child cannot have a complete physical development; it cannot come to full maturity. Perhaps that is strong language, but it cannot perhaps be put too strongly as a mere exclamation point to call attention to the subject. The city child to-day is not only totally different in all its motor habits from the country child, but the city child is liable always to imperfect muscular development, and therefore to precocity. The city child has no chance to get at nature, and therefore science, which deals with nature, he approaches in an abnormal, rather inverted way. Take a child and give him a microscope when he gets into the high school or college; is not that an inversion of the natural order of things? He ought to have been introduced to nature in the way the old naturalists were introduced. He does not know nature at first hand, he has not been brought up close to it, he has not served an apprenticeship to that old-fashioned paganism, with a little fetichism in it, that the race has passed through, and which the child ought to pass through. If you do not give a child an experience of paganism that way you are building your Christian character on sand; and just so, if you do not give a child a basis for science in free contact with nature, but introduce him to science through the microscope or through any technique of the laboratory, he cannot have a deep, strong love of nature. We tested many years ago Boston children on entering school. I think it was 23 per cent. of the children had never seen growing wheat or any of the cereals, didn't know where they came from. I think it was something like 52 per cent.

didn't know what was inside of them, whether bone or stick. A great many had never seen a robin, never seen a blue-bird; and I think it was 71 per cent. of these six-year-old Boston children that didn't know beans, even in Boston. Now what can you expect of a love of science built without a foundation? There must be some acquaintance with nature first, and you cannot get acquaintance with nature sitting down; you have got to get out of doors. We must bring children in contact with nature, and that works for physical development.

Now I must add one more thought, and it is this: I spoke of rhythm; perhaps I can finish what I began to say about it. Rhythm underlies poetry, music, our gait, everything. There is in man what is called a psychic constant; for instance, in most it is about .76 of a second, regular time; it varies a little with different people. That psychic constant is the time toward which we approximate if we close the eyes and attempt to beat time. That this "leg-time" is the constant toward which one gravitates, that is shown by a great many experiments. The power of rhythm and its effect upon the genesis of Americanitis is shown in this: that if you accelerate that rhythm you produce a state of tension; if you retard it you produce a state of rest. What mother would ever think of putting her child to sleep by patting its shoulder in this way? (indicating irregular, accelerated motion). On the contrary, the motion grows slower and slower, and lighter and lighter. I am told it is now being introduced into neurasthenic retreats. Try it sometime when you are sleepless.

Another thing laboratory experiments show: let a drop of water fall on your hand, or any other part of your body once, two seconds, three seconds even; you will be surprised to find what an effect it has; nobody can stand it very long. It has the power that repeated stimuli always have; it exhausts to the very last degree. Now, wherever we can substitute a more moderate and a stronger movement for a more rapid and lighter, I think we are doing a good thing. What is the matter with the kindergarten? One thing is this: they illustrate the same precocity, the children handle little toothpicks, and very small things that require finger movements. If they would deal with objects twenty-five times as large and heavy, if they would work

with rods laid a foot long, so that it would throw the strain from the fine muscles back to the shoulder muscles,—for we know that the cells connected with them have been traced directly to the large fundamental muscles, which develop first,—they would throw the strain where it belongs. Everything depends on exercising the trunk, which gives poise and motion, and wherever you can substitute a more deliberate motion or rhythm of work and speech you are substituting a healthy for a morbid nervous diathesis. A person whose rhythm is established, and at a rate which gives poise, can have large ideas, and others cannot. The power of it is everything. I think if we had the assembly of our daily efforts registered and recorded we should see what has been shown in the study of the daily rhythm of children of late—that they accelerate as the day advances, that the movements are likely to be a little faster when they begin to be a little tired. In order, therefore, to be earnest and serious the muscle habits must have a deliberate rhythm and forceful rhythm. There has been a careful study of the hand in the last year, which shows that range of motion and intensity are inversely to each other. The main thing is this: that all thought, I will not say is, but is connected with, the innervation of muscles. Many go so far as to say that there is no thought possible without a corresponding change in muscle tension. This is, as everybody knows, the basis of these slight movements that constitute mind reading, which is really muscle reading. That shows us that the two are connected; localization shows the same thing. So we are educating the brain when we educate the muscles.

A complete system of education will begin with regimen and digestion, with the habits that give strength, and end with the education of those very slight, subtle, complicated movements which, I will not quite say constitute thought, but which it is a pre-requisite to teach first, which must be taught upon the basis of the solid, all-round education of that half of the body which is made up of muscle tissue.

EFFECT OF CERTAIN EXERCISES UPON THE PULSE RATE.

WM. G. ANDERSON, M. D.

The object of this paper is: First, to present the results of observations, made during the past winter, showing the effect of certain movements of the body on the action of the heart after running and jumping exercises. Second, to discuss briefly the reasons for placing precipitant, slow leg, and breathing exercises in the Swedish day's order where they are. Third, to bring up for discussion a few questions pertinent to the subject.

Why the tests were made.

Some years ago my attention was called to the reason for placing the jumping exercises after the motions for the "abdomen, fore part of the body, and alternate side movements." Baron Posse, in his "Chief Characteristics of the Swedish System," places the slow leg exercises before the jump, following it with breathing exercises. Jakob Bolin places precipitant work, his term for running and jumping, after the abdominal movements. The quieting of the action of the heart after violent exercises by slow leg motion, and rhythmic breathing exercises seemed to be such a cardinal point in the Ling system, that I adopted the method and am still using it. As there is a unanimity of opinion among the advocates of the day's order of the Ling system, relative to the placing of such exercises, allow me to quote from one of the authorities, which quotation will agree in the main with the opinions expressed by other leaders. "The movements mentioned above, namely for the front, sides of the waist, and abdomen, following each other in the order named, are performed with gradually increasing force. By these movements the system is prepared for the next following. These are the more vigorous exercises of running and jumping. With these movements the culmination of the day's order is reached, after which the accelerated action of the heart must be normalized, and the body prepared for rest. This is accomplished by slow, measured leg movements, accompanied by deep rhythmic breathing movements." (Dr. Enebuske.)

It has often occurred to me that this arrangement of the approach to and departure from the precipitant work was like

Mark Twain's description of the ascent of Mt. Vesuvius—long, gradual, moderate to the top; short and quick to the base. The first question, therefore, presents itself: If it is necessary to go through eight series of movements to prepare the heart for the strain of the jumping exercises, why are only two groups given to normalize its action? What objection can there be, in the first series of these exercises arranged according to the Swedish day's order, to placing the running next to the abdominal work, when they can be so given in a second series, while in the more advanced arrangements they are sometimes placed in the middle of a group? I ask these questions for information, because I do not clearly understand why the changes are so made, and I know that there are a number of American teachers who are placed in a similar position. Another question arises: If the exercises involve a high degree of heart exertion, but never exceed the danger limit, why are so few movements given to quiet the action of the heart? Why not give "*in place rest*," as well as slow leg exercises? If the precipitant work quickens the action of the heart and lungs, should we for the time attempt to normalize them? Is it not nature's method of meeting the condition? In any case of exertion would not rest be as judicious as a continuation of exercise? Is not the moment of complete relaxation between each of the movements of as much value in quieting the action of the heart as the exercises which follow? It was because I wished to test, so far as possible, this part of the day's order, that I made the experiments referred to.

The facilities offered by the Yale psychological laboratory for doing research work have been used to advantage. It may be well to say here that these tests were made impartially. They were not pursued to prove a point, but rather that we might learn. I am not ready to say that I am convinced, either way, but I do know that I shall be satisfied to continue giving slow leg and breathing exercises after precipitant work if that seems best. Or, I shall be just as willing to give the jumping exercises at the beginning or middle of a day's order, if it seems more judicious to do so.

My first teaching came from Dr. Enebuske, and I naturally adhere to his opinions. Later, I found Mr. Bolin's were about the same as those of Dr. Enebuske. The habit of giving the

exercises as they did became more fixed, but aside from this I shall be perfectly willing to abide by the result, if I can reach one, and it seems to me that with the opportunities offered by the psychological laboratories connected with our leading colleges, we shall be able to approximate the truth by means of tests, experiments and delicate instruments.

The work being done here at Yale by Dr. Scripture, at Harvard by Dr. Fitz, cannot but be of great service to the cause of physical education, while so high an authority as Dr. Ladd makes the statement that the relation between psychology and gymnastics is an intimate one. The teacher whose duty it is to mould the bodies of men, and so the mind and feelings, should understand the elements of psychology, if, as has been stated, psychology is the mother of the science of education. In this research work I did not go out of my way to attack any system, nor to harbor any prejudice, but if a system is rational, and there is a scientific reason for everything adopted, then let it stand the test of investigation.

What the tests were:

With the aid of the kymograph, spymograph, time indicator and smoked drum, these tests were made, with the assistance of members of the Senior and Junior classes of the Anderson Normal School of Gymnastics. Dr. Seaver took a number of the readings, and I am under obligations to Miss Turner and Miss Coburn, of the Anderson school, for tracings and drawings. Part of the tests were made with a Dudgeon spymograph. I am not sufficiently satisfied with the tests made, or the tracings, to present all of them to-day, but your attention is called to a few of the outlines, which are very similar to others secured by the same tests. Although the figures given to-day are taken from one hundred and twenty persons, we have kept a record of a very much larger number, and it is found that when we increase the numbers there is not a great difference in the results. Of the one hundred and twenty, forty were experimented upon to show the effect of slow leg exercises and rhythmic breathing upon the action of the heart after running; forty more tried standing in "place rest" after the run, and the last forty took abdominal movements. In every case the normal pulse was read for thirty seconds. This was followed immediately by running in place,

the person taking about seventy-five steps in half a minute, after which the pulse rate was recorded for a period of thirty seconds; then followed four slow stepping movements with each foot, and arm raising shoulder high to the side, accompanied by inspiration and lowered with expiration. The breathing movements were given four times, after which the pulse was read for the last time. We must bear in mind that during the half minute after the running exercise, while the pulse was being read, there was a period of rest; this might correspond to the "moment of complete relaxation" mentioned before. The second series of tests were given in much the same way, with this exception, that in place of the slow leg and breathing exercises, the pupil was required to hold the position of place rest thirty seconds, and in the last series the body was bent backward four to six times.

In the first series the total number of beats of the heart for forty persons was sixteen hundred and twenty-nine (1629). After the run the pulse rate went up to 2227. It fell again after the leg work and breathing exercises to 1668. In the second series of tests, the normal pulse was 1648; after the run 2228, and after place rest 1646. The third series showed the normal pulse 1699, after the run 2326, and after abdominal work 1703. The following table will perhaps make this plainer:

TEST.			
1. Slow leg and breathing exercises,	1629	2227	1668
2. Rest, or "In place rest," - -	1648	2228	1646
3. Abdominal work, - -	1699	2326	1703

Another set of figures will show that in the case of the first forty who were experimented upon, the action of the heart was reduced below the normal in thirteen cases, above the normal in twenty cases, and was equal in seven. In the second test, the action of the heart was below normal in seventeen, did not reach the normal in eighteen, and was equal in five. In the last test, the heart beat was reduced below normal in nineteen, above normal in eighteen, and just the same in three, so that by looking at the following table we find that the abdominal work brought the heart down below the normal in the greatest number of cases, while the slow leg work and breathing shows the

least reduction. In the first test, we find the greatest number who are above the normal after "normalizing exercises," while in the second and third they were the same. Finally the slow leg and breathing exercises brought seven back to exactly normal condition; in place rest was next, and abdominal work last.

Test.	Below.	Above.	Normal.
1. Slow leg and breathing exercises, -	13	20	7
2. Rest, - - - -	17	18	5
3. Abdominal work, - - -	19	18	3

Plate I., standing normal, 1-2 m.—38.

Plate II., 30 seconds run, pulse rate 75 for 1-2 m.

Plate III., after slow leg work and breathing exercises, pulse for 1-2 m.—39.

Plate IV., after 1-2 m. "in place rest," pulse 39.

The tests recorded upon the revolving drum will not be presented in this paper because they do not show quite so plainly as those by the Dudgeon spymograph. Plate No. 1 shows the normal pulse, 38 beats for half a minute, person standing. As this tracing is a fair sample of those taken from the normal pulse, I shall not give others. Plate No. 2 shows the pulse rate after the patient has run in place for thirty seconds, the rate being

75. Plate No. 3 gives the story of the pulse after thirty seconds of slow leg work and breathing exercises, the rate being 39, or one greater than normal. Plate No. 4 shows the action of the pulse after thirty seconds in place rest. We notice by comparing plate No. 4 with plate No. 1 that it approaches nearer the normal than plate No. 3. In plate No. 4 the cardiac impulse is greater than in plate No. 3, the length of the tidal wave is about the same, there is some difference in the dicrotic wave, while the diastolic curve in No. 4 seems to be nearer that of No. 1 than does No. 3.

Conclusions—

I do not wish to place myself on record as saying that these tests prove a point. They are interesting however, and should lend some weight to these conclusions: Slow leg and breathing exercises tend to "normalize" the action of the heart after running, but this is also true of standing "in place rest," and abdominal work. (But which is best?) Pupils seem to prefer the first method if the choice is left to them.

The tracings show that *rest* brings the pulse outline nearer the normal than do breathing exercises and slow leg work.

The statement has been made that "The Swedish system is rational, and there is a scientific reason for everything adopted."

There is no doubt in my mind that the Swedish system in its theory approaches nearer perfection than any other; but there is some uncertainty among American teachers as to whether the statement should be made that the arrangement of the day's order is scientific. If this is true, and I have no reason for wishing it was not, the facts ought to be brought forward to prove it.

REACTION-TIME AND TIME-MEMORY IN GYMNASTIC WORK.

By E. W. Scripture, Ph. D. (Leipsic), Yale University.

(Owing to the illness of Dr. Scripture, the experiments here described were performed by Dr. C. B. Bliss, Yale University.)

The objects of gymnastic work are, or should be, two: 1. Bodily health and development; 2, mental development and health. In actual gymnasium work the latter remains practically unrecognized. The general statement, that gymnastic work benefits the will and the moral character, is too vague to be of any practical worth. Modern science and modern psychology demand that definite facts and figures shall be given.

You do not say in an off-hand manner that exercise is good for the health or develops the body in a general way. Quite the contrary—you measure the chest and the muscles, you carefully notice any spinal curvature, any defects of bodily development; then you prescribe appropriate exercises. That is the only correct way of managing gymnastic work, and is the way you ought to do in psychological matters, also; you should test and measure the mental powers of your subject and prescribe just the appropriate kind of exercise to correct his mental faults, to develop the weak parts and to maintain a sound mind in a sound body. You ought to know just as much about the mental processes involved in gymnastic training as about the names and sizes of the different muscles. Nevertheless, no one has yet investigated the influence of various exercises on the various mental processes; no one has even pointed out how the mental acts and conditions of persons in training differ from those of other persons. The reason for this is clear. Although the two branches of the new psychology, experimental and clinical psychology, have abundance of methods and material which can be applied to gymnastic work, yet there is no teacher of physical training, I think, who has ever entered the psychological laboratory to learn its methods and applications.

You might ask me why we psychologists do not work out the psychology of exercise. I must answer that we are far too busy investigating the fundamental laws of mental life to have any time to spend on practical applications. We are scientists,

not technologists, and our duty ends when we have invented methods and discovered facts. It is your business, as practical people, to take up the matter where we leave it; we will furnish the rough metal, but you must shape it for practical service. To illustrate this I shall here not attempt to go over a multitude of applications, but will choose only two factors of mental life and will try to show how they are or may be developed by gymnastic work. These are reaction-time and time-memory.

(1) By reaction-time we mean the time that actually elapses between a signal to act and the execution of the act. I will show you an example of reaction-time as exhibited by persons starting for a race. This has never before been measured; we have been able to do so by the invention of an electric-contact for the starter's pistol and a break-contact for the runner.

The end of the barrel of the pistol with contact is shown in Figure 1.

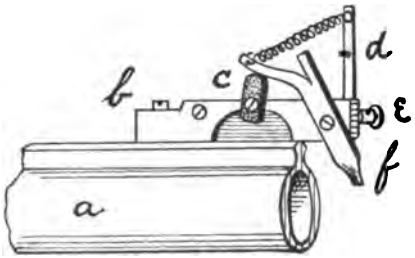


FIG. 1.

The blast from the pistol moves the small fan projecting down near, but not in front of, the mouth. A spring makes it fly back immediately. This interrupts an electric circuit for a moment.

The runner's key is shown in Figure 2.

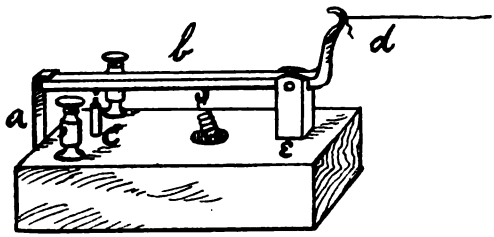


FIG. 2.

A thread is stretched from the hook of the key to a pin in the clothes of the runner. When the thread is pulled, the circuit is broken.

There are various methods of measuring small intervals of time. The one we generally use is accurate to 0.001 of a second, and gives us less labor than any other equally accurate method. Simpler and less accurate methods can be readily substituted.

Our method is to have a surface of smoked paper on a revolving cylinder passing under a metal point vibrating 100 times per second. The pistol and the key are arranged electrically so that whenever the circuit is broken a spark flies off the metal point to the drum. The vibrations of the point make a wavy time-line on the drum, and the sparks put dots on it. The number of waves and tenths of a wave between the two dots will give the elapsed time.

To perform the experiment the runner is placed at "set" and the pistol is fired; the starting of the runner jerks and breaks the thread. The firing of the pistol breaks contact for an instant and makes a dot; the jerking of the key likewise makes a dot. The number of tenths of a wave between the two give the elapsed time in thousandths of a second.

No experiments having been made, I cannot give you any definite results beyond the fact the runner loses from 0.1 to 0.5 of a second on account of his reaction-time. Persons with long reaction-time cannot succeed as sprinters. Moreover, we know from analogous cases that it makes a difference whether the person is attending to, or thinking of, the expected sound or his legs. To attend to the wrong one may mean loss of the race. I might also point out that loud sounds, such as a pistol shot, lengthen a person's reaction-time. All cases of response to a signal are cases of reaction-time. Simple reaction-time is to a great degree a psychological phenomenon depending on mental conditions that have been extensively investigated in the laboratory.

Let us turn to a more complicated form of reaction involving two additional processes, discrimination and choice. I have here (Fig. 3) an arrangement for giving two different signals, to which the person is to react. For example, I place a pugil-

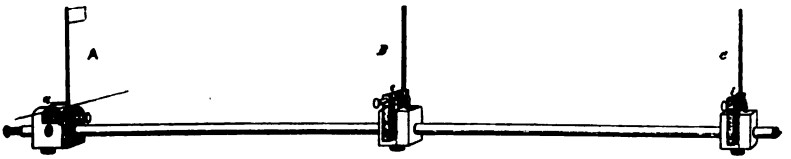


FIG. 3.

ist with his fist just touching the vertical rod *C*. When the signal *A* moves, he is to strike a blow. The moving of *A* makes a record and the moving of *C* makes a record; the time between the two records gives the simple reaction-time as before. Now I give him a more difficult problem. When the signal *A* moves to the right he is to strike a blow; when to the left he is not to move. He thus has to be sure of what he sees and has to choose between moving and not moving. His reaction-time will be found to be much lengthened. If it is desired to know just how much of the whole time is taken by the mental processes of discrimination and choice, the result for simple reaction-time is subtracted from the complex time; the remainder will be due to these two processes. If a fencer place his foil against the rod, his discrimination and choice-time can likewise be measured. You yourselves can furnish countless examples where you discriminate, choose and act; each of these processes takes more or less time.

I will mention that a second rod B can be placed at any desired distance from C in order to measure the rapidity of the blow or the lunge after it has once started. I might go on to more complicated forms or might show other means of measurement. But if you will agree with me that the proper cultivation of quick and accurate discrimination and quick and certain choice are probably the most vital points in the mental life of a man,—points on which have hung defeat or victory of an army as depending on its general, the safety of a ship on its captain, the fall of a ministry on the leader of the opposition, or the winning of a foot-ball game by the skill of the eleven,—I shall not need to urge you to have a little more psychology in the gymnasium.

As no one else pays any attention to the cultivation of a rapid and reliable reaction-time, the task of developing a youth in this respect falls into your hands. By simple methods you

can determine which kind of reaction, muscular or sensory, needs cultivating. If the youth has a long, simple reaction-time, you can select games and exercises that will make it shorter. If his discrimination and choice are too slow you can set him to boxing or playing tennis.

2. Time-memory, or the accuracy with which we can remember intervals of time, forms, in connection with reaction-time, the basis of rhythmic action. Rhythmic action is keeping time to some repeated sound or sight. If we actually wait till the sound be heard we are simply reacting; in such a case there would be no difference between regular and irregular sounds. In keeping time, however, we anticipate the moment the sound is to occur and generally plan the act to occur at the moment of the sound. We cannot keep time to irregular sounds, but with regular sounds we are sometimes ahead, sometimes correct and sometimes behind.

Let us see how we can measure a person's regularity and accuracy in keeping time with his foot to a sound. I have here a specially made stop-watch which not only indicates fifths of a second, but can also be made to write seconds or fifths of a second on the smoked paper of a revolving cylinder, and can further be made to break an electric current at seconds or fifths. An ordinary telegraph-sounder is connected electrically with the stop-watch, so that a sharp click is heard at every beat. An electric contact is placed on the heel of the person, and is so arranged (in our method) as to make a spark on the drum whenever the heel hits the floor. The watch is set to beat seconds. At each beat a click is heard and a mark is made on the drum. The person keeping time with his heel makes sparks that are supposed to coincide with the sounds. The record on the drum shows you that they do not coincide, and, moreover, that each person has his own peculiar fault.

By putting the contact on the toe of the shoe and letting the watch beat fifths of a second, the rhythmic time of running can be also investigated.

By running the current through a pair of iron dumb-bells the accuracy and regularity of the person can be tested with front and back movements, the rataplan, etc.

With a little ingenuity such connections could be made with all gymnastic apparatus with which regular movements are to be made, e. g., Indian clubs, wands, oars in the practice tank or in the shell, etc.

Defective time-memory and consequently irregular or inaccurate or irregular-inaccurate rhythmic action are exceedingly common. Proper exercises and games can, however, greatly improve most cases.

I have thus called your attention to two out of the countless number of mental processes that enter into gymnastic exercise and might be developed or corrected in the gymnasium. In conclusion, let me impress upon you the fact that the most valuable part of a man's mental development comes not from schoolrooms and colleges, from geography and Latin, but from his games and plays as a child and from his gymnastic training and sports as a youth. To have a sound mind it is not sufficient to have a sound body; the mind itself must be attended to. To the Greek the gymnasium was the central point of a man's life, and I sincerely hope that with a broadened conception of the scope of a gymnasium our youth will obtain in it the full *mental*, *manly* training that now finds no place in school or college.

REMARKS ON DISCUSSION OF HEAVY WORK.

MR. ARNOLD. It seems to me that what Dr. Enebuske said in regard to heavy gymnastics is true. There is no such thing as heavy gymnastics. The term is only relative, not absolute. What is heavy for me may not be heavy for somebody else. So it is with heavy work for women and for girls. I believe that there are physiological limits to heavy gymnastics, so-called, or to the ability to perform apparatus work and perform certain feats by women; and those physiological limits are not, as suggested by Dr. Gulick, to be found in the shoulders, in the ability of women to use the shoulders to advantage, or in the lack of muscle on them, because I think it is nowadays conceded that function precedes the organ, and I am not at all convinced

that women's shoulders have always been as narrow as to-day. It does not follow, by any means, that apparatus work would narrow the pelvis, would injure it in any way. Apparatus work necessarily means abdominal work, and leg work, and I do not see how this should work in narrowing the pelvis to any extent. Broad shoulders no not mean narrow pelvis, by any means. The physiological limits are put by the calling of a woman to bear children. With men I often find the highest development, as far as feats go, in the years between twenty-five and thirty-five, when they attain their maximum ability as far as gymnastic apparatus work goes. We will have few women reach that age in a condition that would permit their taking exercise of the same kind. That is the only physiological limit which I would be willing and able to recognize.

What we are confronted with to-day is the fact that most women who come into the gymnasium are women not having had earlier training. Some come as infants, and some come in a weaker state than an infant. There have been experiments made as to the ability of a new-born infant to grasp a stick and hold itself suspended by the hands. I think the average duration of time that a new-born infant can grasp it and hold itself suspended is twenty-one seconds. I have made experiments with all the ladies that entered my gymnasium formerly, and very rarely could I find one that was up to the infant ability, if she had not had previous training. So I regarded women coming to the gymnasium as below the infant stage, gymnastically speaking, and directed them as such. Dr. Hall has mentioned the different ways of progression in the development of control over certain sets of muscles. It stands to reason that one has, in order to develop, to take those that are controlled easier first, and follow them in order. It stands to reason, too, that taking a few sets, or one, of muscles, is easier than moving them all at once, and that is practically what heavy gymnastics means. Then the increase in the weight that is to be moved is to be considered. The motion of the hand only, means little weight, the arm means more, the head and arms at one time mean more, the body much more. Thus we get progression from the simple to the complicated. In this way we would come to the apparatus work, and the woman properly prepared from a six years old

child is just as ready to take physical culture and heavy gymnastics as anybody is; and I can only bear testimony to what Dr. Anderson says—any one who has handled boys and girls of the same age will find the female type in the boy. Girls are as apt, up to the physiological limit mentioned, to get as much command over their muscles as a boy, providing, always, that they are properly handled in a progressive way, and that there is no hereditary or other defect, or sickness. Other circumstances being equal, they may do as well up to that limit as a boy does.

DR. GULICK: I confess to not being a woman, and consequently not being able to speak on this subject from Dr. Bissell's standpoint. I have had comparatively little experience in this direction, and furthermore have at hand no definite results from measurements to support what I have to say.

I do not admit that the physiological is the only standpoint, but in order to stir up discussion, will speak from that standpoint. It seems to me there are physiological reasons why women should not do the kind of apparatus work which is largely done by men, where the weight of the body is supported continuously by the arms; first, on account of the smaller structure of the shoulder joints. I have not at hand the comparative measurements showing the difference in shoulder measurements between men and women,—the decrease in width of shoulders, decrease in leverage afforded by the narrower chests,—nor have I measurements showing increased girth of hips and thighs. Such well-known anatomical differences, however, affecting, as they do, the mechanical problems of weight hanging by the shoulders, suggest differences in exercises advisable which I believe to be important.

The women—and those who are here who do such work will please excuse me—the women whom I have seen who excelled in apparatus work were, as a class, as I recall them, not the kind of women who seemed to me most womanly. Their shoulders, as a class, were too heavy; and (I will admit that this is utterly unscientific, but as simply from a man's standpoint,) their hips are too small.

I have tried to teach some women to do heavy gymnastics, and have succeeded perhaps as well as the rest do, but miserably,

compared to the way men are taught to do heavy gymnastics. Dr. Hall told us yesterday, and my own very limited experience is in the same direction, that, on the whole, power and range of motion are not found together—that they vary inversely. Motion at the shoulder joint is not first in importance a question of power; it is first a question of delicacy and of exact control. Motion at the hip is first a question of power, and for that reason I would not throw the weight of the body continuously on the shoulders, and particularly not on to one shoulder. The exercises on the heavy apparatus last night were well done, for women; that must be said always.

DR. ENEBUSKE. I am somewhat unfavorably situated towards a discussion over the value of heavy gymnastics, for the reason that there does not exist in my mind an exact apprehension of what heavy gymnastics is or what light gymnastics is: or if there exists, I fear that definition I should have in my mind would not be exactly the same that seems to me to be present in the remarks of those who have spoken before, or those whom I have heard before using these terms.

We speak of the term light gymnastics, and we find a class taking hold of dumb bells or Indian clubs, and going through various swinging exercises. The child has a dumb bell of one-pound weight, and there comes another class of children, seven or eight years old, together with those fifteen or sixteen years old, all having a one-pound dumb bell in the hand. So we see those people of twenty, thirty and forty years, all with a one-pound dumb bell in their hand. If the dumb bell is the thing that causes the term light gymnastics, then, of course, if it is light gymnastics for thirty or forty or twenty years old, it is not light gymnastics in the same sense for children of seven, eight or fifteen. I do not think there is any essential difference in the weight between the dumb bells and clubs ordinarily used by people of different ages in the gymnasiums. Of course, I am aware that when the term heavy gymnastics is used, generally such exercises are meant as Dr. Gulick referred to. What deserves the name heavy gymnastics I do not clearly see. If at a certain degree of training, taking some exercises with a one-pound dumb bell is the appropriate thing, and then by training with such or other exercises, gradually more and more vigorous,

the condition of the individual has gone up to be equal to greater attempts, and then so-called heavier exercise is taken, which, with reference to the then condition of that individual, is no more difficult than at some previous time to exercise with that dumb bell, I should say what is the reason of calling one thing heavy and another light work, if it is appropriate to the existing condition? The term applies, in my mind, to this: it is the relation between the existing state of training and a given exercise, and it is not heavy because of the apparatus being such and such. I have some experience in training women.

Under the influence of the exercise their powers increase so that after some time suspending the weight of the body by the arms is very easy, because doing it they manifest ease. Therefore, it is not heavy exercises, if given in proper place.

We do not take exercise of that kind, hanging the weight of the body by the arms, simply for the sake of hanging the weight of body by the arms, but for some particular reasons. There is some sense in giving that exercise, and if we come to a closer examination, we can find that among other things that are included one is, it causes a great expansion of chest, because of the relation between the apparatus and the individual, with arms up in this position (illustrating). When hanging in this way, and supposing you hold by two hands, you distribute the weight of the body equally on both the upper extremities, and this equal distribution of weight, being considerable, pulls upon the spine so as to straighten it out. And it is a matter of no small consequence, having introduced into the gymnastics exercises in which that feature of straightening the spine is emphasized, because it is necessary, particularly in the school age and during the whole period of growth, and becomes a necessity, or at least a desirable thing after growth has stopped. There are consequently two important reasons for giving exercise of that kind. I could give also many other reasons, but I think those I have mentioned are sufficient.

My point is this: that it would be well to try to define somewhat more clearly such terms as heavy gymnastics and light gymnastics in a discussion, because, if they are not defined, it is very difficult to talk; different people talk about different things and think they are talking about the same thing.

DR. SARGENT: For a long time I shared the objections of a great many persons to heavy gymnastics for women. In my younger days I looked upon women from perhaps a more romantic point of view than at the present time. They were such delicate creatures, I thought, it was entirely brutish to ask them to circle a bar, or to hold their weight between parallel bars. But accidentally some of them got to work, and I found that they began to develop a considerable degree of efficiency in that way, and gradually we have felt our way along until now the heavy work becomes a very essential part of our curriculum. In saying that, I will accept some of Dr. Gulick's criticism, inasmuch as I do not think all women are fitted to do heavy gymnastics, I do not think some can do it without positive injury. We are now learning to detect at once those objections which would naturally debar women from doing that sort of work. When we come to consider woman anatomically, no muscles are found about the construction of the joints of the arm and chest that are peculiar to her. If a woman is largely developed about the hips and sides, of course it is very difficult for her to support her weight by her hands; it is equally difficult for many men to do that. The great mistake that we make in considering this question of sex, is that we forget that men and women are the product of two factors; the woman has likely inherited from the father and the boy or man from the mother, so if the father was athletic we may get something of the tendency towards the development of the athletic type in the daughter. The whole question of the physical education of women among women must be pursued with great caution. It is a mistake to suppose, (though some people are often alarmed when they see women hanging by their legs and swinging from the bar), that it is much more likely to be injurious than hanging by the hands. Women are better prepared to hold their weight by their legs, according to their size, than men are. We must conduct this question of heavy gymnastics with caution, because women for a long time have been shackled by inappropriate clothing. As far as the movements go, there is nothing in the line of gymnastics, which some women cannot do with just as much readiness as some men, and I do not think that, outside of the so-called esthetic standpoint, there are any physiological reasons why women should not do most things that men do.

DR. GULICK: I am very glad to agree with all that has been said. All women who have hips not too large, who have shoulders strong enough, whose muscles are sufficiently developed to take hold of the work and who are otherwise like men, should do such work as men do. My contention is that most are not so. Women whose weight below the waist is too great, whose shoulders are too small, whose muscles are not sufficiently developed, whose ligaments are not sufficiently strong to suspend the weight easily, should not.

MR. EBERHART. I would just like to make a few remarks about the criticism of Mr. Gulick, about women and men exercising. I think a great deal of objection to heavy work for women is caused by an improper approach to that so-called heavy work, and too late a beginning. The woman begins, not at an age of twenty or twenty-two or eighteen, when she is fully developed, but as a child, and if that child takes heavy work,—not such heavy work as we saw some women perform last night, but work on the so-called heavy apparatus, such as the horizontal bar or the vaulting horse, or the seesaw, or such apparatus as that,—if they begin at the young-enough age they will find that by the time they grow up, when those peculiarities between women and men begin most to show, that they are quite vigorous enough not to be injured by judicious work; and that we are only, or perhaps a great many of us are only now learning to approach that work in the proper way, so that it is absolutely safe. Certainly they delight in that work, and work that any one delights in, that any one likes to do, I claim is more beneficial than that that is a drudge to a person, that they don't want to do, don't do with a vim and like. To emphasize that, we should try to begin when we have the little girls—and between the physiology of a little girl and a little boy the difference is not nearly as great as between a grown-up woman and a grown-up man.

DR. MOSHER: I would like to emphasize the statement which has just been made. I think we must disabuse ourselves of this idea that the primary object of gymnasium work is to fit people to excel in feats of strength. While good in its place, such work is not a necessary part of physical training.

The object we have in view is to perfect the body, both in its outward contour and in its ability to resist the wear and tear which comes to it—to fit the individual for the work of life.

I thoroughly believe in the so-called "heavy work" for women, provided it is properly conducted; and the ability to bear it depends upon the time and work given to development. We have made the mistake in many gymnasia of giving work to girls and women *in advance of their degree of development;* i. e., we have given the work of the adult in physical development to the infant. If gymnastic work were begun in childhood, as it should be, heavy work would be easy and not harmful to the majority of girls and women. We know this to be true by experience. As Dr. Enebuske has said, there is very great reason why our women *should* be educated up to the ability to do "heavy work." Why? Because they have poorly developed skeletons, narrow shoulders, narrow hips, short ribs. We believe that properly directed physical work during the developmental period of life stimulates the growth of bone. Regular and repeated forceful muscular traction increases the size and strengthens the bony surface for attachment of muscles. Heavy work is the work *par excellence* to accomplish this. My protest is against pushing girls into work in *advance of their development.*

One word more, and that is in regard to the importance of strengthening and developing the muscles which make up the abdominal wall.

One of the deplorable lines of loss in women at the present time is weakness of the abdominal muscles which are so important in the performance of many functions. I know of no work in the gymnasium better calculated to correct this than parallel bar work—so often counted of little value to women. Most of the movements which belong to the so-called "heavy work" are well calculated to give the muscular development needed by girls and women. Again, let me say, let us work slowly in our gymnasia, and let us not give to the *child in physical development* the work which belongs to the adult.

A STUDY OF TYPES OF RESPIRATORY MOVEMENTS.

G. W. FITZ, M. D., HARVARD UNIVERSITY.

(This paper is merely an abstract. For description of curves and other tables, together with the added light they throw upon the subject, see Journal of Physiology.)

The relation of the movements of respiration have been several times the subject of investigation with diverse results. Boerhaave (1) called attention to the differences between male and female respiration in 1744. Hutchinson (2) observed and made drawings of changes in antero-posterior diameters by having the shadow of his subject thrown upon a plain surface. He applied the terms diaphragmatic and costal to types of respiratory movement, and by these terms he meant not the extent of movement, as is generally supposed, but their time relations. He observed that in men the respiratory movements begin with the abdomen and that the increase in antero-posterior diameter passes progressively upward; while in women the contrary conditions prevail. He says, further, that all difficult, sudden and extraordinary breathing is costal in the same sense. From the drawings he gives to show the conclusions at which he arrives, the increase of diameter of abdomen in males seems to be about two or three times that of the chest, while in females it is from one-half to two-thirds that of chest. He observed this preponderance of thoracic movement in twenty-four young girls and was at a loss to account for it, but suggests that it may be a "reservation against the period of gestation." He supposes, therefore, that there is a specific sexual difference. Mays (3 and 4), in a comparison of the respiratory movements of Indian girls, concludes that the difference between the movements of civilized males and females is due to the differences of dress. He shows, as typical of normal conditions, tracings in which the abdominal movement is four or five times as extensive as the thoracic. He

(1) Boerhaave Praelect. Academ., Sect. 623 tom. V. p. 144, Ed. Haller, Amst., 1744.

(2) Todd's Cyclop. Anat. and Phys., art Thorax, Vol. LV., Part LI., p. 1080, 1852.

(3) An Experimental Inquiry into Chest Movements of the Indian Female. Therapeutic Gazette, May, 1887.

(4) Id. p. 1 and Breathing Movements as a Cure, Century, August, 1893, p. 151.

supposes, apparently, that in these conditions the abdominal movement is much in excess, and says "the diaphragm has the power of more than doubling the chest capacity, and it is therefore the most essential factor of respiration." Kellogg (5) shows tracings of males and females having the same general appearance as those shown by Mays and reaches similar conclusions. Wilberforce Smith, on the basis of a series of observations, decides that there is no sexual difference.

On the evidence considered by Foster, Rosenthal and Carpenter, they conclude that a sexual difference exists; Waller and Kirk suppose that any observed differences are due to habits of dress.

Without reference to the question of specific sexual differences in respiration, there can be no doubt that dress must interfere with the movements of the diaphragm in those cases where it takes the form of tightly laced corsets, heavy skirts hung from the waist by belts, belts heavily laden with ornaments, or tightly drawn. With clothing of this character the abdominal movements will be partially or wholly restricted. This may be called the restricting influence of dress. There is another possible influence which may be called the inhibiting effect of dress, and this demands our attention. The nervous control of the muscles of respiration has a natural co-ordination. Constricting dress interferes with part of the muscular action which would otherwise result from the stimuli sent out from the respiratory centres, and it does not seem improbable that these centres would, in the course of time, become trained to a new co-ordination which would change the character of the respiration very materially, even after the constriction was removed, the normal co-ordination being recovered slowly or not at all. The restricting effect of clothing must vary greatly in proportion to the extent of the constriction, and it is exceedingly difficult to determine, since, in one way or another, the clothing which produces it will make the use of the ordinary apparatus for recording the movements impossible. For example, a pneumograph over a stiff corset

(5) Experimental Researches Respecting the Relation of Dress to Pelvic Diseases of Women. J. H. Kellogg, M. D., Trans., Mich. State Med. Society, 1888.

(6) On the Alleged Differences between Male and Female Respiratory Movements. British Med. Hour, Oct. 11, 1890.

will show no movement at all, while evidences of increased abdominal pressure may be secured, e. g., by a manometer connected with an air bulb in the rectum or vagina (Kellogg). We may take this as an evidence that any extra space inside the corset is used in respiration. Again, a pneumograph over folds of thick clothing may not show the real movement taking place, since part or all of it can be taken up by the clothing. Any record, therefore, with clothing that constricts the abdomen is to be looked upon with suspicion. It is this second or inhibiting effect of clothing that is here to be studied, and in every case, corsets were removed and tight belts loosened.

There are, therefore, at least three questions which require investigation. 1. What is the normal relation between thoracic and abdominal respiratory movements? 2. Is there any specific difference between the sexes? 3. Does constricting dress change the respiratory co-ordination?

The material which forms a basis for the following study includes thirty-five school boys whose ages range from six to fifteen years; seventy-two school girls, five to twelve years; 123 Harvard students, sixteen to thirty-three years; fifty-two young women from two gymnasiums, seventeen to thirty-four years, together with 124 individuals from various parts of the world found at Chicago during the world's Columbian Exposition, 1893, altogether representing differences of age, sex and race, as well as great variations in habits of dress.

The two movements of the thorax, antero posterior and lateral, may be directly recorded by changes in girth. The change in vertical diameter has to be inferred from the movement of the soft wall of the abdomen anteriorly and laterally. This again shows in the change of girth of the waist and may be recorded in the same manner as is that of the thorax. The apparatus used consists of a piece of rubber tubing about fifteen inches long and one inch in diameter made into a belt pneumograph by the insertion of a light coil of wire* to prevent its collapsing and the addition of a light chain by means of which it was held in place around the body. On account of the length and elasticity of the tubing, the resistance it offered to the movements of respiration was inconsiderable, the subject being nearly unconscious of it; movements at the side of the thorax had no

*Suggested by Dr. Ellis.

tendency to pull the belt about, but were taken up by the ends of the pneumograph, and there was no difficulty in applying it quickly to any individual. One end of the tube was closed, the other connected by smaller tubing with a modification of the Ellis piston recorder, which made tracings corresponding to variations in girth. The caliber of the pneumograph and piston recorder was approximately the same; the height of the tracing, therefore, represents the increase in girth. Two of these pneumographs were used and absolutely simultaneous tracings of thoracic and abdominal movements were secured.

Not to be confused by individual variations in depth of respiration, the relation of chest to abdominal movement has been expressed also in form of a ratio secured by dividing the first of these by the second. For convenience this ratio will be expressed by the symbol $\frac{Th.}{Ab.}$. $\frac{Th.}{Ab.}$ will be less than unity for all individuals with whom the abdominal movement exceeds the thoracic movement and greater under the opposite condition. Definite statements that in men the abdominal movement is twice that of the thorax, and that in women the thoracic is twice the abdominal have been made. Expressed in terms of $\frac{Th.}{Ab.}$ 0.5 or less is assumed to be characteristic for males; 2.0 or more for females. Such statements give a convenient basis on which to group the records of the various classes from whom tracings were secured. The accompanying table contains the results arranged according to this grouping, and also as to excess of abdominal and thoracic movement.

TABLE IX.

Percentage Distribution of Observations in Relation to $\frac{Th.}{Ab.}$:

GROUP.	No. of Observations.	RATIOS.				
		0.0 to 0.5	0.51 to 2.0	2.01 to ∞	0.0 to 1.00	1.01 to ∞
School Boys	35	28.6	62.8	8.6	82.8	17.2
School Girls	72	1.4	83.3	15.3	52.7	47.3
College Men	123	27.7	66.6	5.7	78.0	22.0
Females Uncst. Dress	34	26.5	58.7	14.8	50.0	50.0
Males Uncst. Dress	22	13.7	81.7	4.6	72.8	27.2
Males Const. Dress	24	8.3	50.0	41.7	41.6	58.4
Females Const. Dress	44	2.3	22.6	75.1	2.3	97.7
American Women	52	9.6	59.6	30.8	30.8	69.2

School Boys.—In this class 28.6% are shown to have a value of $\frac{Th.}{Ab.}$ from 0.0 to 0.5; 8.6% a value of $\frac{Th.}{Ab.}$ from 2.0 to ∞; while 62.8% have values intermediate between these extremes, i. e., with neither thoracic nor abdominal movement twice as extensive as the other. In 82.8% there was neither equality of movement nor predominance of the abdominal movement; in 17.2% thoracic movement predominated to some extent. The most noticeable things brought out by this table is the large number with whom normal breathing is not characterized by a decided predominance of either factor.

School Girls.—Of these 1.4% are shown to have a value of $\frac{Th.}{Ab.}$ from 0.0. to 0.50; 15.3% from 2.0 to ∞, while 83.3% have values intermediate between these extremes; 52.7% of the observations showed abdominal movements equal to or exceeding in extent the thoracic movements, and 47.3% in which the thoracic movements exceeded the abdominal.

College Men.—For values of $\frac{Th.}{Ab.}$ from 0.0 to 0.50, we find 27.7% of the observations; from 2.0 to ∞, 5.7%, and intermediate, 66.6%; 78.0% have a value of $\frac{Th.}{Ab.}$ from 0.0 to 1.0, and 22.0% from 1.01 to ∞.

Females with Unconstricting Dress.—No evidence can be found in this group that race, age, or child-bearing affects the respiratory ratios. The individuals of the several races here represented are distributed without regularity throughout the table. The dress of children of most people is loose, whatever that of adults may be, and for this reason we find more young children in this group than in that of constricted females. The presence of the youngest in the first part of the table, taken in connection with the distribution of ages in the remainder of the table, seems to indicate that the clothing of adult women in almost all races is constricting in some degree; 26.5% have values of $\frac{Th.}{Ab.}$ from 0.0 to 0.50; 14.8%, from 2.0 to ∞, and 58.7% are intermediate. In 50% $\frac{Th.}{Ab.}$ is 1.0 or less; in 50% it is more than 1.0.

Males with Unconstricting Dress.—13.7% have values of $\frac{Th.}{Ab.}$ from 0.0 to 0.50; 4.6%, from 2.0 to ∞, and 81.7% are intermediate. In 72.8% $\frac{Th.}{Ab.}$ is 1.0 or less; in 27.2% it is more than 1.0.

Males with Constricting Dress.—We have gathered under the name Syrian the males found on the Midway in the Turkish

Theatre and Bedouin Encampment. In race they include Hebrews and Bedouins, Greeks and mixtures of the three found so commonly in Syria. On the whole, these people are much given to wearing tight belts and sashes, and many have been tightly constricted from the time of swaddling cloths. The effect of this constriction is shown in much the same way that we shall find it manifested in the group of American women. Some of the individuals had not been restricted to the same extent as the majority of their fellows, but it was found impossible to make any selection; 8.3% are to be found with values of $\frac{Th.}{Ab.}$ from 0.0 to 0.5; 41.7% from 2.0 to ∞, and 50%, intermediate; 41.6 are 1.0 or less; 58.4% are more than 1.0.

Females with Constricting Dress.—None of the women in this group wear clothing which leaves their respiratory movements at all times unrestricted, and, to repeat, all had removed or loosened the articles of dress which produced the constriction. For values of $\frac{Th.}{Ab.}$ from 0.0 to 0.5, 2.3% are to be found; from 2 to ∞, 75.1%; intermediate, 22.6%. For values 1.0 or less than 1.0, 2.3%; greater than 1.0, 97.7%.

American Women.—In this group are included all degrees of constriction and non-constriction. We have here both the tight-lacer and the woman who not only has never worn corsets but endeavors as much as possible to remove the weight of clothing from the waist. As in case of the group treated together as males with constricting clothing, it was impossible to make a distinct line of separation between them; 9.6% are to be found from $\frac{Th.}{Ab.}$, 0.0 to 0.5; 30.8%, from 2.0 to ∞, and 59.6%, intermediate. With values 1.0 or less, 30.8%; 1.01 and over, 69.2%.

Having considered in detail the eight classes into which the records secured are naturally divided, it remains for us to consider the three questions with which we started.

1st. What is the normal relation between thoracic and abdominal respiratory movements?

The table shows for School Boys and College Men and Males Unconstricted that too small a number have abdominal movements twice as extensive as the thoracic to admit of its description as the normal type of male respiration. By distributing the records of these individuals we find that 50 or 27.7% of the observations have values of $\frac{Th.}{Ab.}$ from 0.50 to 0.69.

2d. Is there a specific difference between the sexes sufficient to suggest an inherited characteristic?

So far as the data go, the evidence suggests that there is no essential sexual difference between male and female breathing movements.

First, we will consider the percentages given for American Women and Males with Constricting Dress in Table IX. These two classes are almost identical in respect to constriction; both contain individuals whose respiratory movements have been practically unrestricted and others who have been tightly bound. The statement that these individuals have been considered constricted on the basis of inquiry into their mode of dressing, and not on the basis of their records, may need repetition. The comparison of these averages seems to show that the inhibiting influence of dress is in result the same in males and females and indicates that the natural breathing is the same in character for both classes since they are similarly affected by the same influence.

Second, by distributing the records of School Girls and Females with Unconstricting Dress, to whom we must look for the determination of natural female respiratory movements, we find the largest group, 22 or 20.7%, is $\frac{Th.}{Ab.}$ to 0.89, and the average value of $\frac{Th.}{Ab.}$ in the group is 0.782. We may say, then, that for every 10mm. of abdominal movement, we find 7.82 of thoracic movement. This value is 28% greater than the value of $\frac{Th.}{Ab.}$ for men, but on impartial consideration of the conditions and results it seems such a difference may easily be considered to be the effects of the constriction which actually existed in most cases. The mean value of $\frac{Th.}{Ab.}$ secured from the class of unconstricted females was 0.58.

While the study of the records show that the mean female ratio is distinctly higher than the male, we must admit that such difference is comparatively slight and that there are many of the records of females with abdominal movements equal to or greater than those of a large percentage of males, and not differing from them in characteristics, suggesting that there is no essential difference in types. The slight residual difference shown by the tables is sufficiently accounted for by the fact that the clothing of females of all ages is somewhat constricting, supported as it is almost universally by tight bands from the waist.

Again the statement has been made that thoracic breathing is a provision of nature against the period of gestation, but we find individuals, who have borne children, scattered throughout the tables without regard to respiratory ratio, showing that gestation is not a factor in the production of thoracic respiration, and hence is not a factor in heredity. Our feeling is, after a careful study of the individuals tested and of the tables of results, that there is no difference between male and female respiratory types other than that produced by clothing.

3d. Does constricting dress change the respiratory co-ordination?

As regards the influence of dress we may state the results of the investigations are as follows: There is a very clear relation between preponderance of thoracic respiration and the evidence of constriction in dress, and this association is much closer than is shown by the table, for our classes are undoubtedly mixed in most cases. The records of Americans were divided primarily on the basis of age and sex and the records of individuals of other races on the basis of sex and constriction. In making this division we were guided entirely by observation and inquiry into modes of dressing, any suspicion of constriction putting an individual into the constriction class. This method was adopted for the sake of unprejudiced study. In this way individuals were placed in constricted groups whose respiration had not been affected by this mode of dress, and on the other hand some constricted records were included in unconstricted classes. We must consider that all interference with respiration, such as tight clothing, belts and bands was removed, hence there was no mechanical hindrance to chest and abdominal movement.

Weakness of muscles caused by constriction will not account for the result, for the respiratory muscles, aside from the diaphragm, are trunk muscles, and are kept in condition irrespective of use in respiration, and in case of the diaphragm we do not find atrophy in corset wearers, as shown by some tests with an abdominal belt dynamometer. It is, apparently, the disordering of a delicate nervous mechanism which in some individuals is thrown out of balance by so slight an obstruction as an inelastic string about the waist. It follows that the permanent effect is exceedingly variable, depending upon the ease with which this nervous control can be modified.

To sum up we may say:

1. That in children of both sexes there is apparently very little difference in the type of respiratory movements;

2. Between girls and women, boys and men, there is also very little or no difference;

3. That child-bearing does not seem to affect it;

4. That the usual type of respiration is one in which the movement is fairly equally distributed between chest and abdomen, the abdominal being somewhat in excess;

5. From the standpoint of amount of air moved by the chest and abdomen for typical unconstricted individuals ($\frac{Th.}{Ab.}$, 0.6) the movement of the chest contributed about the same bulk of air as does the movement of the abdomen;

6. That constricting dress causes preponderance of thoracic movement in ratio to its restriction of movement and the sensitiveness of the nervous co-ordination, and

7. The difference in respiratory movements between civilized adults, males and females, are chiefly due to this effect of dress.

Dr. Fitz next exhibited and explained various apparatus for making physiological and psychological tests.

The first instrument shown was one devised to measure the quickness and accuracy with which an individual could grasp and meet certain unexpected conditions. Then followed a description of apparatus for studying the respiratory movements, and of one for measuring the strength with which the chest or the abdomen can be expanded. The speaker continued:

I have here an apparatus which was devised to give a large number of foot tracings or imprints in a short time. It consists of a box for holding papers, with compartments for an inked roller, a tube for ink, and benzine for washing off the ink; a table or board which is lined in quarter inches, but which may just as well be unlined, which is inked evenly, and then upon that a paper placed which has printed directions on one side, and which calls for certain items—name, age, weight, height, sex, nationality, etc., years during which soft-soled shoes have been worn, and years during which stiff-soled ones have been used, occupation of individual, occupation of father and mother,

general health, and the amount of exercise taken, and whether the individual is in the habit of being on the feet much or little. This paper is laid on the inked surface, and the individual steps upon it, and wherever the weight comes you have an imprint of the foot. I have here several such imprints. In taking these, precaution has to be used that the full weight is borne upon each foot in succession.

The method is a very valuable one. What I hope to get from it is this: to see how far the shoeing of children is important in relation to flat foot, that is, whether children should wear spring-heeled shoes or such as support the arch. It is nonsense to state that giving a stiff sole to a child is going to take away all work from the arch. When he stands upon the ball of his foot, as he does at each step, he is supporting his weight practically through the various ligaments and tendons which do legitimately support his arch. I am getting Indian records and shall get negroes as well as whites, so as to work out this question as fully as possible.

DR. FITZ: I am very much pleased with the strength weight index; it seems to me that that gives a measure of the real value of the muscular development, and also is a check against adipose tissue; but the lung capacity weight index, it seems to me, is a questionable one. What does lung capacity mean? So far as I can see, practically flexibility of ribs, that is, looseness of ribs in their ligamentous attachments, and looseness also of the cartilages which permit their motion, and also the freedom with which the diaphragm may descend. It means simply the range of motion of the chest and abdominal walls. It is hard to conceive that that has any special reference to health. An individual with a freely moving chest wall may be as well and strong, but not necessarily in better health or stronger than one who has less freely moving abdominal or chest walls; and when that lung capacity, which is variable in that way, is divided by the weight, what is it that you get? We have in the lung capacity an item which does not vary materially, and we have that divided by one that does. The heavier individual will have a smaller vital index, so called; the lighter individual will have a higher vital index, and of course the heavier individual will not be able to raise himself so well or climb the rope because he

is handicapped by the weight, and thus you have the same relation holding true between the two indices. I would like Dr. Enebuske to clear that up, if he will.

DR. ENEBUSKE: As Dr. Fitz remarks, this index is dependent upon two items. The changes in both weight and lung capacity influence the significance of this index, and influence it very markedly. Change in lung capacity does not necessarily mean any change in the development of the substance of the lung itself, but it means a difference, which sometimes is considerable, in the ability to take advantage of that. It is the ease of flexibility of the ribs, and consequently the diminished resistance to the breathing movements. I have been able to ascertain, to my own satisfaction at least, that any such influences as the degree of humidity of the air influences the breathing capacity. Very moist air compared with very dry air means a difference of some 200 cubic centimeters in the breathing capacity, and this difference manifests itself instantly in the working capacity. There are many other things that influence it. One student came and told me that she had found her lung capacity had gone down since the last measurement. I found the cause to be a cold. That cold had not deprived her of lung substance, but it had deprived her of the capacity of taking advantage of that lung substance, for the time being. Another had worried intensely, and had lost sleep, and those things influenced her vital capacity, and she was unable to do the same thing as before. So far, then, for reasoning over the subject; the other thing is to clear the facts, which everybody I think will be able to ascertain by trying.

This index has another significance, which I did not dwell upon for lack of time; it indicates one of the conditions of grace under vigorous action.

DR. FITZ: I would also like to emphasize one thing. In connection with photographing curvature cases, the objection just made is, to a certain extent, a valid one, but I think not to the extent emphasized there, because we do not wish to get the curvature cases in a forced position; they should be in the position which they assume themselves, and to a certain extent you are measuring there the relaxation of the ligaments,

and so if you force them into other attitudes you do not measure them in any sense. It is important to get them in their own attitudes, and not force them into others which are not their own. Of course in some cases where the curvature is slight, where it is practically a question of attitude, there is a possibility of very great change, and successive photographs will show very great differences. But where there is more or less volition, it is important that you get the full measure of that, and a thing that we have tried at the Children's Hospital in Boston is to measure the extent of variation; that is, have the child stand in as good a position as he can and then have him slouch, and see how far he is relaxed. In that way you get the range, and that shows the two extremes—how far he can correct himself and how far he is out in *toto*. In repeated photographs taken in that way you get a measure of improvement in the power to hold one's self in correct attitude. The idea of threads across in front of the subject is an excellent one. We have used it for the past year in the hospital and found it more serviceable than anything else.

THE IMPORTANCE OF MAINTAINING THE PELVIS IN NORMAL OBLIQUITY.

By Eliza M. Mosher, M. D., Brooklyn, N. Y.

It doubtless was wise and economic on the part of the Creator to ally man with the beasts which were to be his servants, by giving him a place in common with them, among vertebrate forms.

The modifications needful to the swinging of a spinal column and pelvis (with their related parts), from the horizontal to the perpendicular, and for a harmonious readjustment of internal organs, to a many storied *upright* human tenement, called for the skill of a master hand, whether ages were consumed in the process of evolution, or whether it was accomplished by a special creative act.

There are few subjects of greater interest to the scientist, than the study of these modifications, and none better fitted to awaken in him a profound belief in a beneficent and all-wise Creator.

Not least among the details essential to such a readjustment may be counted the careful poising of the human pelvis. To balance such a structure upon two treacherous upright columns (the legs) with sufficient stability to make it a firm pedestal for the support of a superstructure like the trunk, was a task of no mean proportions. To place it beneath a mobile mass of abdominal viscera, without permitting encroachment upon the delicate and loosely hung organs which it contains, was a master stroke! By what device, we ask, was this important adjustment made? By one so simple that it is often overlooked, not only overlooked, but permitted to be lost through careless habits of posture, insufficient exercise, wrong modes of dress, etc.

It consisted in balancing the pelvis at such an angle of obliquity with relation to the superimposed spinal column and abdominal cylinder, as should place its undiaphragmed inlet behind and "out from under" the load of swinging loops of intestine.

This angle of obliquity, measured in well-formed, healthy adult women is one of 50 degrees (using the sacro lumbar articulation and summit of the pubic symphysis as points from which to measure it). With the pelvis held at such an angle, and the sternum elevated and placed on line with the pubis, the contents of the abdomen gravitate toward the lower anterior wall of the latter, to rest upon it and the pubic symphysis instead of dropping directly into the upturned mouth of the pelvic basin. If we seek the mechanism whereby this adjustment is made so important in its bearing upon the health of individuals (especially girls and women), we find it primarily in the position of the acetabula *behind* the lateral median line of the pelvis, thus causing the latter to balance on the thighs in anterior inclination; and secondarily in the conjoined action of the extensors of the legs and feet, with the muscles which pass downward *from the pubic bones*, to which may be added the Iliacus and Psoas of each side. With the legs in strong extension, the muscles named, acting from their insertion upward, draw the anterior half of the pelvis toward the thighs, into the position of anterior obliquity. Upon the development and vigorous use of these muscles the maintenance of the normal obliquity of the pelvis in standing

and walking largely depends. The muscles which lift the ribs, and those which move the upper portion of the trunk forward also play an important part in diminishing intra pelvic pressure.

In the sitting posture, the pelvis rests upon its rocker-like ischia. The degree of obliquity which shall be maintained depends largely upon the height of the seat, and the position and shape of the support placed against the back; with no support, and with a seat *sufficiently high* to place the acetabula a little *above* the level of the knees, the weight of the legs (owing to the high attachment of the *rectus femoris* muscles), draws the pelvis forward and into normal obliquity.

With the ribs and sternum elevated and the head and arms adjusted with reference to utilizing the force of gravitation, the trunk maintains itself in this position with little expenditure of muscle force. If in addition a well-shaped support be applied to the lumbar region of the back, this position can be maintained a longer time without general fatigue than any other.

A low seat with slanting back rolls the pelvis upon its ischia so that the weight of the superimposed trunk rests largely upon the sacrum and coccyx, parts unfitted to receive it, at the same time the lessened obliquity of the pelvis permits the abdominal viscera to impinge upon and crowd its organs, nerves and blood vessels.

Furthermore, to maintain the body in equilibrium in this position the head and shoulders drop forward, shortening the anterior line of the body, thus adding pressure downward and backward to the force of gravitation already acting within the abdomen and pelvis.

Although the adjustment of the pelvis in the human skeleton has been made, as we have seen, with consummate skill, and the apparatus for maintaining it in normal position has been carefully supplied, men and women have been slow to recognize its important relation to the health of individuals, and the far-reaching baneful results arising from a disregard of it.

In the active open-air life of primitive man, when walking, running, climbing, sitting cross legged and sleeping upon the hard ground were the "day's order," there was little to tempt the body into habits of posture which lessened pelvic obliquity. In this day, when a sedentary in-door life is the common one, in

which little vigorous use of the extensor muscles of the legs is required, when the feet are crippled by high heels and narrow toes in one sex and stiff unbending soles in the other, when the corset steel and its accompaniment, tight clothing at the waist line and over the lower ribs, unbalance the body, throwing the pubic symphysis forward and upward, when our homes, schools, lecture halls and churches are supplied with seats upon which no person can balance the trunk in a normal and healthful position, we find ourselves surrounded by influences which tend to make us ignore the Creator's safeguards.

What wonder is it if we hear it said "Man has reached the highest point of physical development to which evolution can carry him."* Henceforth he must maintain it or retrograde. Retrogression has *already* begun on many lines, and unless physical educators become sufficiently keen sighted to discover the points at which most serious loss is going on, and influential enough to reach the masses, and put a check upon it, there is just ground for fear in regard to the future of the nations.

Having called attention to *one* point in the physical structure of the human body at which deterioration is certainly going on, I ask the members of this society to seriously consider measures calculated to check it. The doctors are too busy devising modes of treatment, and operations to remedy the pathological conditions caused by it, to correct the habits which produce those conditions. In this day of specialism, every physician should be able to supplement his own work by passing his patients over to a properly qualified physical teacher whose business it should be to carefully search the *exterior of the body* for possible causes of internal disorders, and having found them, he (or she, if the patient is a woman,) should be able to direct the necessary corrective work, which the exigencies of a doctor's life made impossible.

To make physical education what we all desire to see it, viz.: the natural protector and safeguard of mankind, we still have many advance steps to take.

We should have in all gymnasia (as we have already in some) a *special* teacher for corrective work, under whose supervision every student should come, not only on admission but

* Prof. Henry Drummond, Lectures on "The Ascent of Man." 1893.

from time to time during his gymnasium course. This teacher should retain, under *his or her training*, all those whose bodies are unsymmetrical, or improperly balanced, and all who are deficient in muscular development in special regions, and until correction has been made, they should not be allowed to enter the classes for general work.

More *practical didactic* teaching should be given to students in reference to the mechanics of the body, and to the importance of cultivating right habits of posture, exercise, etc., *outside* the gymnasium.

Physical culture should not be confined to the gymnasium. There should be wide-awake teachers at work everywhere, with private classes of adults, correcting bad physical habits, and teaching the laws which underlie the maintenance of health.

Those who take up the work of physical education to-day are not handicapped as were our earnest and enthusiastic pioneers, who not only were obliged to build up the pathway before them, but to mould public opinion upon the subject.

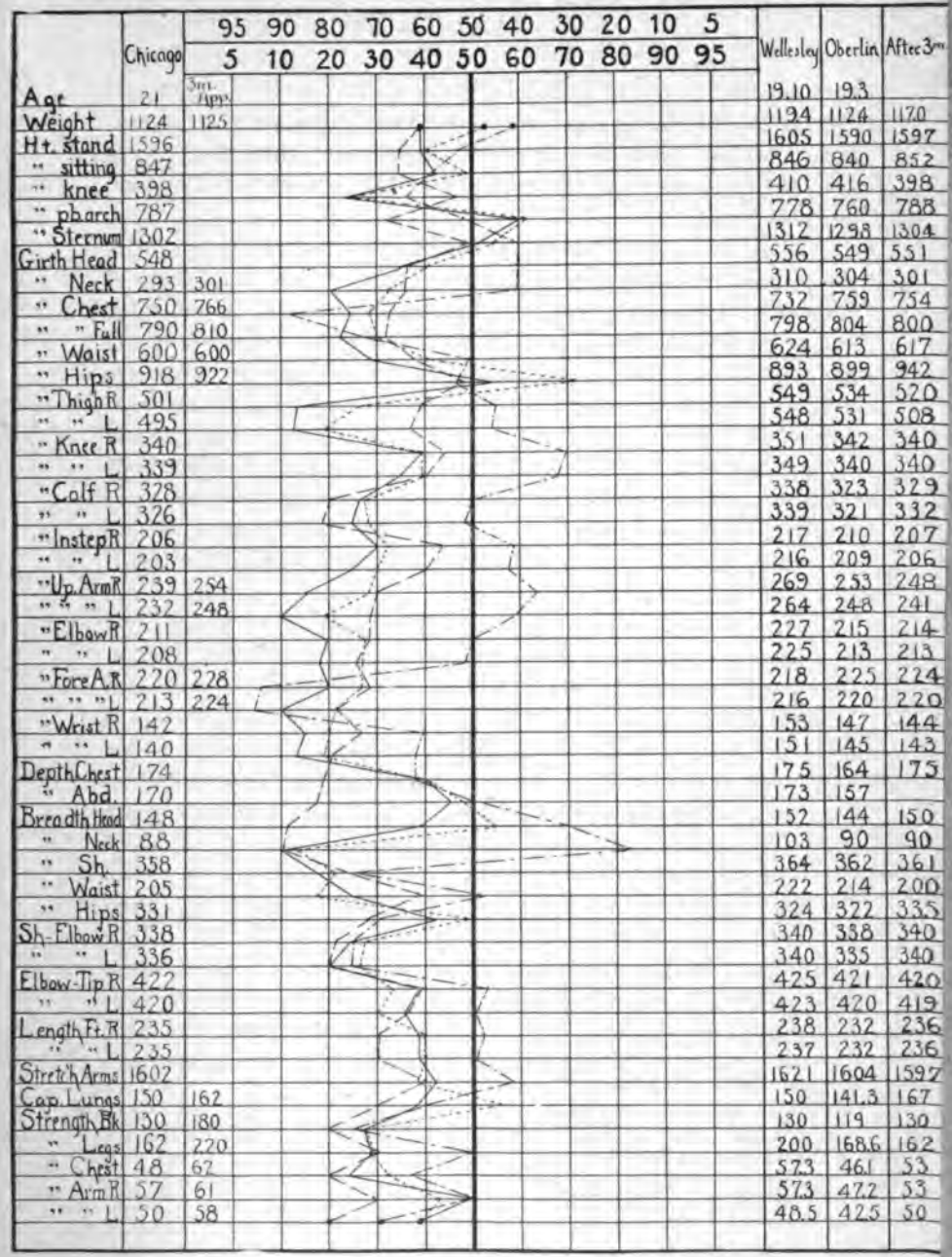
The time is now ripe, it seems to me, for a positive advance on all lines, and especially in the direction of corrective work.

A FEW FIGURES ON OCCUPATION AND EXERCISE.

ALICE B. FOSTER, M. D.

In the tabulation of our statistics much has been said of the "personal equation;" and it is an element which we cannot afford to forget, even for a moment, since many comparisons of race, geographical locality or occupation are invalidated by the uncertainty which this involves. In the comparisons offered by the charts here presented, the value claimed is that, as all the measures were taken by the same examiner, whatever is due to personal error must appear equally in all; whatever differences remain must find some other explanation than the tension of the tape or the pressure of the calipers.

Only by amassing much data from many localities, occupations and examiners, can we reach a composite which approximates *the* American type, and with which individual work may



	Chicago	5m. Appr.	Wellesley	Oberlin	After 3m
Age	21		19.10	19.3	
Weight	1124	1125	1194	1124	1170
Ht. stand	1596		1605	1590	1597
" sitting	847		846	840	852
" knee	398		410	416	398
" pb.arch	787		778	760	788
" Sternum	1302		1312	1298	1304
Girth Head	548		556	549	551
" Neck	293	301	310	304	301
" Chest	750	766	732	759	754
" " Full	790	810	798	804	800
" Waist	600	600	624	613	617
" Hips	918	922	893	899	942
"Thigh R	501		549	534	520
" " L	495		548	531	508
"Knee R	340		351	342	340
" " L	339		349	340	340
"Calf R	328		338	323	329
" " L	326		339	321	332
"Instep R	206		217	210	207
" " L	203		216	209	206
"Up. Arm R	239	254	269	253	248
" " " L	232	248	264	248	241
"Elbow R	211		227	215	214
" " L	208		225	213	213
"Fore A. R	220	228	218	225	224
" " " L	213	224	216	220	220
"Wrist R	142		153	147	144
" " L	140		151	145	143
Depth Chest	174		175	164	175
" Abd.	170		173	157	
Breadth Head	148		152	144	150
" Neck	88		103	90	90
" Sh.	358		364	362	361
" Waist	205		222	214	200
" Hips	331		324	322	335
Sh-Elbow R	338		340	338	340
" " L	336		340	335	340
Elbow-Tip R	422		425	421	420
" " L	420		423	420	419
Length Ft. R	235		238	232	236
" " L	235		237	232	236
Stretch Arms	1602		1621	1604	1597
Cap. Lungs	150	162	150	141.3	167
Strength Bk	130	180	130	119	130
" Legs	162	220	200	168.6	162
" Chest	48	62	57.3	46.1	53
" Arm R	57	61	57.3	47.2	53
" " L	50	58	48.5	42.5	50

CHART No. 1.

EXPLANATION:

——— Chicago (line *A* in text).

· · · · · · · · Chicago, after 3 months (line *B* in text).

— — — — — Oberlin (line *G* in text).

— · — · — · — Wellesley (line *H* in text).

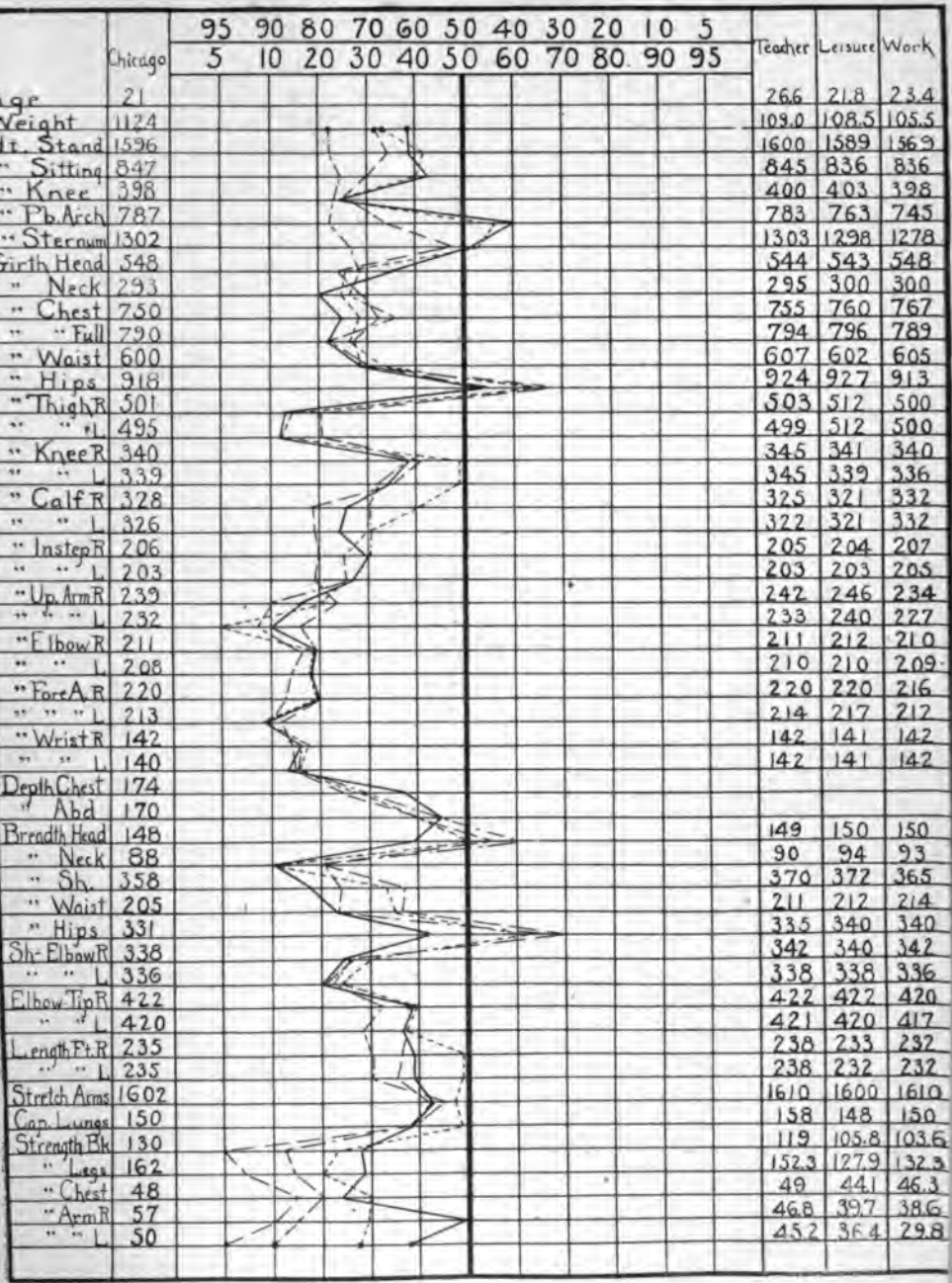
be compared as with a standard. For this reason, I have used Dr. Sargent's blanks (for females between eighteen and twenty-six years) on which to plot these comparisons, since they represent the greatest mass and variety of observations for this sex, age and country.

Chart No. 1 presents the 50% class in tables prepared from the present freshman and sophomore classes in the University of Chicago. Line *A* shows the composite of students on entering, and was drawn from the present freshman class. Line *B* shows the type of the present sophomore class, according to measures taken in February, 1893, after three months of exercise *without apparatus*, and almost wholly on Swedish lines. The general similarity of the lines shows that two circumstances affect both equally, namely, eccentricities of examiner and geographical locality, to which I shall refer again. The divergences may be attributed to the one difference of condition—three months of free exercise.

It is true that by the annual fluctuations of weight we should expect a gain in that, and in certain dependent girths, between October and February, and this we find in girth and breadth of hips and waist. That adipose constitutes the gain *from the waist upward* is disproved by the later measure (see Chart No. 1, figures in second column), which show *further gain*, not loss, in June, notwithstanding weight, and hip and waist girths have returned to the October figures.

The differences which we note are gains throughout (from the starting point of even heights), especially marked in girths of chest at rest, chest expanded (which has a greater gain than the former), thighs and upper limbs, and in strength of chest and capacity of lungs. Strengths of back, legs and left forearm have not changed, while right forearm has dropped 7% nearer the left. Gain in sitting height I attribute to straighter carriage.

After three months more of general exercise *with* apparatus, without special reference to chest, as many as possible of the same students were again partially measured, producing the figures in Chart No. 1, second column. Capacity of lungs and the expanded chest, as relative to the "natural" chest, are less than their maximum, but have by no means returned to enter-



	Chicago	Teacher	Leisure	Work
		95 90 80 70 60 50 40 30 20 10 5		
		5 10 20 30 40 50 60 70 80 90 95		
Age	21	26.6	21.8	23.4
Weight	1124	109.0	108.5	105.5
Ht. Stand	1596	1600	1589	1569
" Sitting	847	845	836	836
" Knee	398	400	403	398
" Pb. Arch	787	783	763	745
" Sternum	1302	1303	1298	1278
Girth Head	548	544	543	548
" Neck	293	295	300	300
" Chest	750	755	760	767
" " Full	790	794	796	789
" Waist	600	607	602	605
" Hips	918	924	927	913
" Thigh R	501	503	512	500
" " L	495	499	512	500
" Knee R	340	345	341	340
" " L	339	345	339	336
" Calf R	328	325	321	332
" " L	326	322	321	332
" Instep R	206	205	204	207
" " L	203	203	203	205
" Up. Arm R	239	242	246	234
" " L	232	233	240	227
" Elbow R	211	211	212	210
" " L	208	210	210	209
" Fore A. R	220	220	220	216
" " " L	213	214	217	212
" Wrist R	142	142	141	142
" " L	140	142	141	142
Depth Chest	174			
" Abd	170			
Breadth Head	148	149	150	150
" Neck	88	90	94	93
" Sh.	358	370	372	365
" Waist	205	211	212	214
" Hips	331	335	340	340
Sh-Elbow R	338	342	340	342
" " L	336	338	338	336
Elbow-Tip R	422	422	422	420
" " L	420	421	420	417
Length Ft. R	235	238	233	232
" " L	235	238	232	232
Stretch Arms	1602	1610	1600	1610
Cap. Lungs	150	158	148	150
Strength Bk	130	119	105.8	103.6
" Legs	162	152.3	127.9	132.3
" Chest	48	49	44.1	46.3
" Arm R	57	46.8	39.7	38.6
" " L	50	45.2	36.4	29.8

CHART No. 2.

EXPLANATION:

——— Chicago (line *A* in text).

····· Teachers (line *D* in text).

– – – – Leisure class (line *E* in text).

–·–·– Working class (line *F* in text).

ing measures, as waist and hip girths have; and all other measures show gains, especially in strengths. Symmetry of forearm is further approached, not by loss in the right, this time, but by greater gain in the left. ("General health" was also better.)

In Chart No. 2 a class composed wholly of teachers was plotted (line *D*); and, given the same examiner, locality and similar occupation, we are not surprised to find the variations from the student type very few and slight. Increase in hips probably depends on the five years in age. The most conspicuous difference is in strength of forearm, especially right; it hardly needs explanation.

In Chart No. 2 we have 100 members of the "leisure" class (line *E*); and here is a marked variation of type. Heights, lengths, and girths of limbs throughout are exceedingly symmetrical. It is fair to conclude that the members of this class, through the formative years of infancy and childhood, have enjoyed good conditions for natural development, and the result is conspicuous. As the greatest variations are in hip girth and breadth, we may infer a good deal of adipose, and probably so account for the knee, since the other joints are not large. But in strength tests the leisure class loses its prestige. A fall of 25% in back and legs and 40% on forearm speaks for itself.

Chart No. 2 shows as great a divergence in another direction. It is drawn from self-supporting women (line *F*), including mainly book-keepers, stenographers, clerks, saleswomen, etc. It suggests several points.

First, the stature and heights dependent thereon are very low. As we said of the previous class, that they had had every advantage for early growth, so here we infer that the conditions have evidently not been of the best; for although the symmetry is good, all are surpassed by 75% of those measured. Upper limb girths fall below our student, but there is an advantage on chest and calf. The other girths are alike. Hip breadth is the highest measure—47% above the height proportion. Strengths are conspicuously low.

Lack of exercise in the leisure class suggests only inertia, but here sedentary occupations and lack of time are the cause. These women need exercise most of all; and since they cannot have it in working hours, our Y. W. C. A.'s are doing a noble

work in supplying evening classes at low cost. They offer every inducement to draw these girls from sofa or rocking chair, even when wearied with a day of work. For the work in these cases means: either (1), constant strain, as in unchanging attitude at desk or typewriter; or (2), one-sided work, developing the stronger or more skillful side at the expense of the other, as shown in the increased difference between right and left forearm girths; or (3), constant small motions under nervous tension, with movement enough to exhaust, but not breadth or freedom enough to call forth strong, healthy, responsive play of the heart and lungs. This is shown not so much in the figures, even, as in the histories of headache, backache, dyspepsia, biliousness, sleeplessness, and kindred ills.

In all these, I have kept the line *A* of the Chicago freshman as a basis of comparison with the "student" type, for the reason already given, that it is the work of the same examiner.

Now let us ask, how does the work of this examiner differ from others? That will be better proved a few years hence, when I look forward to comparing my freshman curve with one drawn by a different teacher, from the same material, i. e., freshman classes of the same locality.

In the meantime, let us compare it with lines copied from Oberlin (Line *G*, chart No. 1), and from Wellesley (Line *H*). These three curves are alike in that they represent the same occupation—student freshman; they differ in the other two conditions —examiner and geographical location. How to divide the differences between these two sources we cannot yet *prove;* but some points we may fairly conjecture.

In height, standing, and height of sternum, you will surely agree that not much is left to chance, so I think we may credit the New England type with an extra half inch, Oberlin and Chicago both dropping below.

The variations in knee and pubic arch may be called errors, because there are opportunities for great differences in method. I admit my Chicago figure is too low for knee. The first year I took abdominal depth, without instruction, I found a mean of 19, which would reach the 95% class! This illustrates another point, the importance of identical training for those who furnish data, or, failing that, of frequent comparisons with the work of others.

In the girths, I will uphold my Chicago line (*A*), for I have used the Narragansett Co.'s "spring tape," and even above uniformity in training, I place uniformity, at least uniform accuracy, of apparatus. But even if the spring tape drew a tenser measure about the girths pictured in Line *A* than did the examiner's fingers at Wellesley and Oberlin, it failed to reduce the hip girth to the same proportions. So I will claim this also as a geographical variation, and give my evidence to the popular belief, that the New England girl is taller, slenderer, of a type more "nervous" or sinewy, and less adipose. This is argued, too, by her excess in weight over the others, showing (since hip and thighs are not large) that the flesh is firm.

In girth of head, New England takes a lead of 15% over her height proportion, while Ohio and Illinois are merely correct.

Girth of neck is very susceptible of compression, and I think I shall credit the spring tape with my low figure; Oberlin is just right, and Wellesley keeps her advantage in proportion to head girths.

In natural chest, Oberlin is beautifully symmetrical, but Chicago has dropped 10%. This is not personal error, for by referring back, we find high figures for sitting height and height of sternum, implying a long thorax. This is supported by the fact that, notwithstanding the low chest girth, capacity of lungs comes up to Wellesley and surpasses Oberlin. But there is a personal variation to account for Wellesley's drop, for this measure had been taken *after exhalation*. Her "expanded" chest, however, is also much too low.

Waist girth. New England is sensible and doesn't lace. Oberlin is nearly in proportion, but Chicago is a wee bit smaller than she should be. Retributive justice follows promptly in the obvious result of very high hip girth. Thigh girth is small and strength of legs falls back below the others.

Oberlin and Chicago are correct in knee girth, but Wellesley goes up; and, with all respect, I am inclined here to find a "personal" element, for elbow and wrist do not bear out any theory of large joints, nor hip girth of adipose.

Wellesley is right on calf, and Oberlin below Chicago. Well, we had just had a World's Fair.

Chicago loses and Wellesley gains on arm girths. Part of the difference I will acknowledge, and the rest I will attribute to tension of tape.

From "calf" throughout the upper limb, it is interesting to see how closely Chicago follows Oberlin, but Wellesley drops extraordinarily on forearm. This is carried out in the strength, where the right barely matches Chicago, and the left falls below it.

In depth of chest, Chicago rises to the Wellesley mark, passing Oberlin; and capacity of lungs corresponds.

Abdominal depth runs high and refers back to the small waist and large hips, which appear again in breadth. Chicago keeps good proportion otherwise, but the "Boston girl" rises again in breadth of head.

Breadth of neck we pass over, because it is a measure very susceptible to the "personal" consideration.

In breadth of waist the shoulder relation is maintained with increased degrees. In hip breadth Wellesley falls, which coincides with the type we have assumed for this section.

Arm lengths match in all three, and in Oberlin and Chicago forearms are the same, but on this, and foot lengths also, Wellesley rises—according to her type.

It is interesting to note that the Chicago foot is in perfect proportion; so another popular fallacy yields to science.

Wellesley, naturally, gains in strength of arms.

In strengths, Wellesley and Chicago match in capacity of lungs and strength of back, while Oberlin falls below. In legs and chest (*muscular* test) Wellesley leads again, but in forearm she loses.

Summary: New England shows greater heights, longer bones, large head, small chest, small hips, little adipose, firm flesh, good nervous strength, but low chest capacity and poor forearms.

Oberlin is the most symmetrical of the three.

Chicago shows smaller stature, with smaller waist, larger hips, small limbs, good depths, good lengths, and well proportioned strengths.

So much for geographical differences. Now, in what do these three resemble each other and differ from the composite

type? Beginning with right thigh, follow the three lines. In lower limbs the thigh and calf are low, knee and instep high. In the upper, muscle and bone measures both are low. Shoulder breadth in all is low. Waist is nearer normal; upper arm is short; forearm, normal; length of foot is normal. Capacity of lungs is a little low; strength of back very low; strength of legs better, but (except in Wellesley) still below proportion; strength of chest, low; right arm, good; left, poor.

What do we conclude? All the measures which are determined in early life are good—the college girl had the favorable conditions of the "leisure" class. The legs, which get a certain amount of exercise inevitably, are good in bone measure, but muscularly a little below par. The upper limb has been delayed in growth, and girth measures of bone and muscle *both* are deficient. Why? I think it is fair to say, because the brain has been developed at the expense of the body, during the last few years of school life. But at their age our students still have time to correct this before the chance of growth ceases, and this is the time when the college gymnasium instructor has the opportunity to perfect the type.

I have not come as the advocate of any "system;" I do not urge you to work with German, Swedish, or any other apparatus or exercises, but I *do* strongly urge you who are teaching young women, to measure your pupil by the accepted standards, and *use* your own data, in comparison with others, even as you go along. Change continually as your mass of observations grows, but *do not* wait for 1500, or 1000, or even 500 measures, while the first 500, or 1000, or 1500 girls are passing out of your power to improve and the bones ossifying.

The lines *A* and *B* on Chart No. 1 were drawn from not over 100 students each, yet the exactness with which they correspond, with the sole difference of the evident advantage of the exercise, proves that this is, very closely, the type.

As to what exercise to use, that must be referred to individual judgment. Whatever the "personal element" is in charts, it is almost everything on the gymnasium floor. Use the system or the exercise that will produce the effect needed; but we cannot afford to forget what some one has said, that the exercise a girl *takes* is what affects her, not the exercise she is *advised* to

take. We do not "make pills with eight corners," and we must sugar-coat our doctoring, but the sugar alone will not do the work in a gymnasium. The right exercise must be included among the games and fun, and done honestly, too. The girls must say: "This hour is the most fun in the day," "I'd rather give up one of my studies;" but also, "I feel so much brighter; I can study better; I don't get sleepy over my lessons now;" "I never have been so well in my life." "I was afraid to enter the University, because I expected to lose so much time by my bad colds, but I haven't had a cold this winter." "I never expected to be as well as I am." "Papa says this gymnasium has been worth hundreds of dollars to him."

And then, after the last match game of the basket-ball season, you must be able to take the tape and rod and prove to either defeated or triumphant captain, and to her mother, and to her physician, that her physical proportions have improved with her health.

And, above all, be sure that you do no harm in trying to do good. Safety should come last, and first, and all through. An accident to a weak ankle, an attack of neuralgia around a weak heart, one little accident in basket ball to some one whom you should not have allowed to play, may discredit months of honest, thorough, conscientious work.

REMARKS AND DISCUSSION ON THE LITERATURE CONCERNING PHYSICAL TRAINING.

By Dr. Hartwell.

Though there was a short session at Chicago of the Section on the History and Bibliography of Physical Training, this is practically the first meeting of this newly constituted section. In the absence of the senior members of the committee, it devolves upon me to preside at this time.

The committee has no formal report to make, indeed, it has no material out of which to fashion a report. A report upon history and bibliography for the year should be based upon a collection of recent publications. This Association is not in a

financial condition to furnish its committee with the necessary material for compiling a proper bibliography of current works. If there were any one who had time to flit about from library to library in this country he would have his labor for his pains. He could not make a satisfactory bibliography of current works bearing either on the theories or the practice of physical training and athletics. In most cases he would find the catalogues, even of college libraries, so arranged that a satisfactory classified list, which should correspond to a logical analysis of the subject, could not be had. That is to say, those who have the new systems of library cataloguing in hand have not evolved as yet a satisfactory classification for physical training. Why should they? The newspapers and the college presidents are alike uncritical in talking about "physical culture" when they mean something very different. They are mixed in their utterances on athletics and gymnastics because they do not understand the difference between them, either in literature or in practice. There is then a great deal to be done in getting material properly classified.

If the history and bibliography of physical training are to influence the spread and growth of physical training, you must have the material on which to form skeleton and complete lists, and you must have people sufficiently interested and sufficiently trained to make intelligent use of that material. The questions in this programme are put there to arouse discussion, so that we may see if in this Association there is enough interest in these subjects to make it worth any one's while to sacrifice money and time toward developing this very much neglected side of the work.

As I say, we have no report to make, no material to base a report on. I have not felt it incumbent upon myself to spend $50 to get together the leading works of the year in order to make a report, and a report made from publishers' catalogues would be nothing but a mass of verbiage. Some valuable books and brochures have appeared within the year. A comprehensive, well-arranged and copiously illustrated encyclopedia entitled "Encyklopädischer Handbuch des Geramden Turnueoeus," under the editorship of Dr. Euler, of Berlin, is now issuing from the press in separate parts. Nothing like it has been printed or even undertaken in the last fifty years, so far as I know.

Mention should be made of a recent American publication which, like a great deal of our educational literature in this country, is conspicuously lacking in any recognition of the subject of physical training. I refer to the Report of the Committee on Secondary School Studies,—commonly termed the Report of the Committee of Ten,—issued recently as a circular of information by the United States Bureau of Education in Washington. The Committee of Ten summarizes the views and recommendations of nine sub-committees of ten each. They deal with a large subject in a large way, and are supposed to represent the best educational thought of the preparatory schools and colleges with regard to the subjects and methods which pertain to the training of young men and young women in secondary schools. You may search their report from cover to cover, but you will find no mention of physical training in it. Why is this? Simply because even the leading educational men in the country are like their rank and file; they do not recognize the fact that physical training has a substantive existence and being, has a history as an organized branch of education in the leading countries of Europe. Indeed, you may read the Report of the Committee of Ten, and, for all that appears on its face or between most of its lines, you would suppose secondary education had its beginning and end in America. It is a most characteristic American performance.

One of our functions should be to remedy such lacks. In this case, the Committee of Ten, representing ninety other committee-men, simply committed the sin of omission, as I suppose. If they had said: Physical training is relatively an inchoate affair in this country; it is characterized by crude methods and ill-defined themes, and we are not ready to discuss it for the same reasons that forbid us from considering manual training, cooking and sewing, as fit subjects for the secondary stage of education,—we could understand their position, and bow to their superior wisdom with such grace as we might command. But as the matter stands, it seems to me, that the majority of the hundred are still enthralled, to some degree, in the dogmas of effete humanism. Science has obtained certain concessions, for which we are duly thankful, but it is doubtless too early to allow it to accomplish its perfect work in secondary schools.

One wonders whether the hundred are as ignorant as they appear to be of the fact, that in most, if not all, of the leading movements in Europe, within the last twenty years, looking toward the improvement of secondary education, serious attention has been paid to this very subject of physical education. The preliminary report of the commission appointed by the Italian government, with university professors, leading educationalists and statesmen composing it, has only recently appeared, but the Committee of Ten knew, or might have known, that the School Conference on Higher Education, in Berlin in 1890, discussed the question of increasing the amount and quality of physical training in the secondary schools of Prussia, and passed resolutions in favor of so doing, and that the course of study has been amended accordingly.

For some years now a government commission in Denmark has been at work on a scheme or code of gymnastics. At least two governmental commissions in France, one of which had the eminent physiologist Marey at its head, have been charged with preparing new gymnastic orders for school use. Physical training in the elementary and secondary schools of France has been materially enlarged and improved within the last five years in accordance with the new order alluded to above.

Unquestionably, the interest in physical training in the world at large, and even in the educational world, is so considerable and active that it is distinctly worth our while to attempt to keep informed—through reviews, abstracts of articles, notes on discussion, official action, etc.,—upon the course of events. It is desirable to attempt this for our own sakes, and doubly desirable to the end that we may be able to infect others with an interest in our subject; that we may cause light to spring out of darkness so that physical training shall become recognized as one of the basal and interlocking parts of education. You cannot educate a growing, living man without employing physical agencies. If you do not understand the nature of the physical agencies which you are using, if you do not understand the nature of the bodily instrument that you are attempting to educate,—it matters not whether you are engaged in physical, mental or moral education,—your efforts will result in more or less of failure. Physical training is a sufficiently dig-

nified, diversified and important subject to enlist our best efforts and our highest energies, and there is room for all who can be induced to aid us in any branch of our work.

Various subjects (referring to the program) have been suggested for your consideration. These questions were printed on the program of the meeting at Chicago, but time was wanting for their full discussion. Some remarks were made upon them by myself, which were amplified and printed. However, so far as I have heard, these remarks have excited but the slightest ripple of attention. Still, though I might be justified in making the same speech over again, I will simply refer you to *Physical Education* for October, 1893, if you wish to know what was said at Chicago on these questions. We have to do here with peculiarly virgin soil. Opportunity will now be given for discussion of these questions. The first question reads as follows:

"For what reasons, and to what extent, should a study of the history and literature of physical training constitute a part of the professional training of teachers of gymnastics?"

DR. GULICK: Mr. Chairman, I would like to know from you what you think this Associatlon can do in these direetions?

DR. HARTWELL: There are certain conditions precedent, I think, to special activity on the part of the Association in any of the lines marked out by the different sections. One is, that we should pay our debts, and then get together and pull together for the purposes which are supposed to animate us. If we cannot do that, I do not see that the work of the sections can be vital, and telling, and productive. In this line, twenty-five or thirty or fifty dollars a year, expended wisely on current literature, would go far toward providing material for a series of abstracts to be printed in the different journals devoted to physical training, for instance, *Mind and Body*, *Physical Education*, and the *Gymnasium*. Some of the more distinctively educational journals might, in time, be led to think that the matter was academical enough for them to pay attention to the subject. A group of three reasonably benevolent and enterprising men and women might, on the basis of an expenditure of $50 annually, present a great deal of fresh, attractive and timely information in the shape of reviews and abstracts of the most noteworthy books and papers—for such are appearing all the time.

Looking toward the longer run of time and the ultimate success and spread of this subject, I hold that a properly constituted committee should bring out a series of condensed monographs, setting forth the best that has been thought and achieved by the generals and strategists,—not the mere drill sergeants and tacticians in this department. The classical papers which have been the turning points, or the beginning points, of movements in physical training in different countries, can be made of great value. For the most part, they cannot be found in English. Of course it is necessary, in order to do the best work or even reasonably good work in this direction, to have a certain familiarity with foreign languages. Persons so gifted can be found, doubtless. If they cannot be in sufficient numbers within our ranks, paid translators and abstractors can easily be discovered.

I think the greatest present lack is a skeleton-classification or bibliography of current literature and of the classic works in physical training. Efforts toward providing notices of current literature have been made—and we should gratefully recognize them—by the editors of different magazines of which I have spoken; but, to cover the ground fully, a working committee, which need not be a large one,—one that is more interested in work than in discussion,—is needed.

As to the matter of providing an exhaustive and scientific bibliography of physical training in any of its departments, it would be practically useless to undertake it in this country at the present time. One who wants to get at the most recent and important works relating to physical education must trot or send all over the country to find them. There is no one who has brains, and interest, and money enough to keep thoroughly abreast of the times in this subject and the subjects closely akin to it. There never has been any such person in the country, so far as I can learn, and no such person is likely to appear soon. It would be useless to go to the college libraries, or the public libraries for the material in question. In my own case, I repair to the library of the Boston Normal School of Gymnastics oftener than to any other, but in recent literature on all branches of education I find the library of Clark University at Worcester much more serviceable than any of the Boston libraries. The library of the U. S. Bureau of Education at Washington is rich in offi-

cial reports and documents, and in Americana. But, as was said before, all of these libraries do not contain the material for a complete and scientific bibliography of gymnastics.

We can, however, it seems to me, take measures to provide for a series of short reviews and criticisms of the best that appears in current literature which would be helpful to earnest students of our subject. We should have to glean, however, in other fields than that of educational literature, as works on school hygiene, and even purely literary books and essays, contain matter of interest and value. Given a committee that should become thoroughly familiar with the literature and monographs, either in the form of translations or of condensed compilations of important books, and articles might be projected which should enable students who wish to become thoroughly informed, to really know how their science and art stand related to other sciences and arts, the history of art, and the history of education.

Here is a question that I will suggest, an extremely practical question, though not on the paper: Is it desirable and possible for the Association to attempt to establish a circulating library for the use of its members?

In Massachusetts we have a pretty highly developed system of public libraries, but they are independent, and do not act in a co-operative way for educational or other purposes. These libraries might do much to stimulate the spirit of inquiry in educational matters were they to combine in circulating a comparatively small number of copies of books and journals which a club of libraries could perfectly afford to purchase, though a single library could not. The plan is perfectly feasible, though it never has been tried, so far as I know. It only requires patience, skill and some imagination on the part of a few liberal and devoted people to start such an enterprise, at a comparatively small cost. By enlisting the aid of school, college, and public librarians, even if we should only succeed in inducing them to purchase the current literature on physical training, a beginning would be made towards spreading a knowledge among teachers, superintendents and school-boards in regard to physical training and its history. I merely throw this out as a suggestion, though I am prepared to learn that librarians are as loth to co-operate for general ends as are the governors and faculties of rival schools and colleges, not to speak of normal schools.

REMARKS ON PHYSICAL EDUCATION AS AN EDUCATIONAL DISCIPLINE.

By E. M. Hartwell, M. D.

Mr. Chairman, Ladies and Gentlemen: The most distinctive conception, with regard to the human body, of modern science as distinguished from ancient science, seems to me to be this: we conceive of the human body as a machine for doing work. Its smooth working we call health, its disturbed or disordered working we call disease, and its stoppage death.

The body is, then, a machine for doing work. Like other machines for doing work, its object is to transform potential energy into free or active energy. This it is enabled to do by reason of the fact that it is made up of living tissues, which are able to transform the materials brought to them by the blood. The potential energy of the food stuffs is transformed into active energy—energy which can be expended in some form of internal or external work. The use made of liberated energy varies at different stages in the life-history of the body. The exterior work which results from the liberation of potential energy within the body appears chiefly in what we call mechanical work—the lifting or propulsion of some body or mass of material against the force of gravity. The body is a complicated machine, comparable less to a windmill or a clock than to a city or an army. It is a communal mechanism, therefore; a complicated machine composed of a great variety and great number of mechanisms, some of which may be considered as leading and of primary importance, while others are of minor importance. The more general mechanisms which subserve the general welfare of the body, we may call general or somatic; and the minor ones, which subserve minor purposes, we may call, for the sake of convenience, organic or special mechanisms. There are two vital necessities which must be provided for by the somatic mechanisms, in this communal structure. In the first place, it must be regularly supplied with an adequate stock of material which it may change into active energy; that is to say, it must be fed. The whole congeries of activities concerned in blood-making, blood-distributing, and blood-cleansing, may be called

circulatory, for convenience; and, secondly, all the different organs, minor and leading, somatic and special, need to be regulated as to the way in which they expend their active energy, their free capital. Therefore a circulation of energy is provided for by general regulative mechanism, known as the nervous system.

The body is a living machine. It does not differ one year from another simply in the size of its parts. At ten years of age the machine is not simply one that is ten times or five times larger than it was at one or two years of age. It is a changing, growing and developing machine, which is perfect as to its structure, complete as to its parts, smoothly working, and capable of its greatest effort during only a portion of its life; that is, during the period of maturity or prime of life. So great are the changes which take place in this developing machine that, on the average, it takes nearly twenty-five years, from birth until maturity is attained, to perfect it as a working mechanism. After this culmination, when the income and expenditure of energy are about equal, there comes a period of decline, then one of deterioration and of disintegration. The same thing happens to the body which happens to other machines that are worn out. It finally breaks down, goes to pieces, is cast on the scrap-heap, decomposes, and becomes plant food, in order that its ashes and gases may be transformed and prepared again to enter into the cycle of animal life.

Taken in its best estate, at its maturity, its parts are complete and capable of full function. They are of full number and full size, and the balance between income and expenditure is practically that of equality. The efficiency, then, of the body at maturity depends, if its parts be complete in number and perfect in their capabilities, upon the degree to which its regulative machinery has been trained or disciplined during the growth and development of its possessor. That is to say, bodily efficiency depends upon the education of its regulative machinery, namely: the brain and nerves.

Complicated though the body be, bewildering as is the variety of its component mechanisms, we may reduce the multifarious activities which signalize the living body to a few leading sorts, if we classify its tissues and organs according to their

dominant functions. First, we have the master tissues, which make up the machinery by whose action the body is brought into relation with objects in the world external to it. The skeletal muscles and the skeleton are the moving, executive machinery, and they are controlled by the nerves, the regulative machinery. The muscular and nervous tissues constitute the master tissues, of which the nervous tissues are of course the more masterful. Then, in the organs which supply the material which is transformed from potential into active energy, we have what may be called the purveyor tissues. These include the whole digestive system, the whole blood-making system and the arterial side of the blood-distributing system, and the arterial portion of the respiratory system. Devoted to the removal of waste matters we have what may be termed the scavenger tissues—the veins, the skin, lungs, renal organs, and a part of the intestinal system.

What can be gotten out of the machine, what a person can do as a human being, as a being different from the possessors of other animal machines, depends upon the amount and character of his free capital. By free capital I mean the free energy which is available after the fixed charges for maintenance and repair have been met. Our distinctively human, individual, professional forms of activity, are all drawn from this fund of free capital. The amount of that fund depends, of course, upon the success with which potential energy has been transformed and expended during the formative and constructive periods which precede maturity. Our success in making that fund go as far as possible depends upon the habits of action which education and circumstances have stamped on our nervous systems.

If, now, we turn to the body of an infant, a suckling, and compare it with that of the adult, we first notice that there is a difference in size. The child at birth, on the average, is about a third as long as he will be when he has reached adult life. He weighs about one-twentieth of what he will weigh when he becomes an adult. If we examine him interiorly, by anatomical analysis, we find that certain of his organs are rudimentary, only blocked out, as it were. The suckling has no teeth, for instance; his organs of sense and sensation are weak; his digestive organs are not what they will be at five or six; nor his

vocal organs what they will be at the age of thirteen or fourteen. If we subject the organs of the babe to finer forms of anatomical analysis, we find that many of his nerves are imperfect, since they lack the protective, insulating sheaths found in the fully developed medullated nerve; that many of his nerve cells are round and as yet unbranched, and that different parts of the body are relatively out of touch with one another. In short, the regulative and executive mechanisms are still unfinished, and therefore incapable of receiving the full benefit of thorough discipline and training.

If we undertake to see how these different organs or mechanisms stand related to each other as to bulk and size, we shall find that the more general, the more important, are the larger and more completely organized; and if we go back to their beginnings, we shall find that it is the most general, somatic organs and functions which emerge first from embryonic chaos. In the embryo the brain and rudiments of the nervous system first attract the eye. The organs concerned in digestion, in circulation, in respiration and secretion develop later. The organs of special sense, and those portions of the nervous system which innervate the organs concerned in breathing, in blood-making and in blood circulation, are more complete and fully organized at birth than are those parts of the nervous system which innervate the muscles of locomotion and manipulation. In the interval between birth and maturity growth and development proceed rapidly and progressively till structural completeness and functional perfection are reached and the organism has become an orderly, communal working-machine.

The executive machinery of the body, broadly speaking, consists of the skeleton. The skeletal muscles and those parts of the brain and nervous system which animate and control the skeletal muscles. According to Michael Foster, the skeleton equals 16.7 per cent. of the total body-weight in the new-born babe, and 15.35 per cent. of the same in the adult. The muscles make up 43.1 per cent. of the body-weight in the adult, but only 23.4 per cent. of the same in the new-born babe; whereas the infant's brain equals 14.34 per cent. of its body-weight, against 2.37 per cent. in the adult. The skeleton increases 26 times in weight during immaturity, the brain 3.7 times, and the

the muscles 48 times; or, taken together, the executive machinery increases 77.7 times in weight between birth and maturity. The period of immaturity, i. e., the period of growth and development, numbers about 24 years, and is roughly divisible into three eight-year periods. The leading feature of the first period is brain-growth—as the brain attains very nearly its full size at from seven to eight years of age. In the second period the skeleton and muscles undergo accelerated growth and approximately reach their full size. The third period is distinctively the period of greatest development of the motor functions; it is the period, therefore, in which discipline of the motor powers should be most diversified and intensified—provided the physical training of the child and youth has been natural and appropriate to their developmental peculiarities.

In the executive department of the federal union of tissues and organs constituting the body, it is only the more general motorial neuro-muscular mechanisms that are well organized at birth; for example, those concerned in distributing and ventilating the blood. As time goes on the normal child enlarges its *repertoire* of motor co-ordinations and learns to sit, stand, walk, and talk. These forms of action are more specialized than those it is capable of at birth, but vastly less specialized than those it is able to acquire after its brain and muscles are fully grown. Here, as elsewhere in the bodily economy, development waits on growth.

"The brain," says Dr. Clouston, in his suggestive work on the "Neuroses of Development," "in gross bulk and weight attains its maximum at 17 or 18, though its full growth, within a few ounces, is reached at seven years. The difference between what the brain of the child of eight and the man of twenty-five can do and resist is quite indescribable. The organ at these two periods might belong to two different species of animals so far as its essential qualities go." The part played in developing the executive qualities of the brain by the education of its servants, the muscles, is too often overlooked and neglected.

That the body of the babe is organized for growth and that of the adult for action, is illustrated by the following table compiled from figures given in "Foster's Physiology:"

Weight of Organ in Percentage of Body-weight.		(1) In new-born babe.	(2) In adult.	Increase in wt. between birth and maturity.
EXECUTIVE ORGANS,	Brain	14.34	2.37	3.7 times.
	Muscles	23.40	43.10	48.0 "
	Skeleton	16.70	15.35	26.0 "
		54.44	60.82	77.7 "
PURVEYOR ORGANS,	Stomach, etc	2.53	2.34	20.0 "
	Liver	4.39	2.77	13.6 "
	Heart	0.89	0.52	15.0 "
		7.81	5.63	48.6 "
SCAVENGER ORGANS,	Kidneys	0.88	0.48	12. "
	Lungs	2.16	2.01	20. "
	Skin	11.3	6.30	12. "
		14.34	8.79	44.0 "

The formal education of the child begins soon after it learns to speak and walk. If its education is to be natural, it should be so planned that it shall recognize the end from the beginning. Now what is the end of education from our present standpoint? It seems to me its end is to shape, to mould, to train, to develop the child and youth so that it shall live as an intelligent, righteous, productive, independent member of the community when it becomes an adult. Considered simply as a matter of physics, with regard to the income and expenditure of energy, the end of education is to manage the training and life of the child so that it may make the most, at each stage, of its free capital, of the stock and savings of free energy which are available after the fixed charges of maintenance and repair have been met. It is so to manage the growth of the body and the development of the functions of the body and mind that, when maturity comes, there shall be as large a fund of free capital as possible to be expended, and that the habits of expenditure shall be those which conform to the rules of right and wrong, to the laws of reason and to the law of greatest economy in the expenditure of energy. The distinctive end of physical training is realized when all our movements, be they habitual, professional, ordinary, or special, are made as easily as possible, with the least possible waste of energy due to irrelevant movements, or self-defeating movements. Then, as the end of all wise saving is spending, as the

end of all thinking and wishing and training is doing, if our energy be expended in deeds, i. e., in muscular contractions which are righteous, which are intelligent, which are easily and economically performed, then we reach the ends of moral, mental and physical education.

We say, therefore, that physical training is basal in its nature and interlocks with mental and moral training. It cannot be separated or divorced from mental or moral training. It may be ignored or not recognized, but do your best, you cannot train a child to do right, to act intelligently, to be a productive worker in any branch of trade or business, or in any of the learned professions, without applying the principles of physical training at some stage or other of your work. Let us consider, for instance, one of the most conventional forms of literary training, that of learning to read aloud. The act of speech is an acquired, muscular act. The child, to learn to speak, imitates the sounds that it hears. In learning to read it learns to make certain sounds which it has been taught to associate with certain arbitrary symbols used in printing and writing. It uses, for the time being, all the comprehension that it has, all the education which it has received, though a muscular act, being a novel act, it is largely a mental act for the child. By practice and by repetition the acquired forms of utterance become habitual. The child can call them forth at will; they are under control of his taste and judgment, so far as the child has them. Later on, the habitual acts involved in speech become automatic, and it is even possible, I suppose, that they may become largely reflex in character. But, whether these movements are novel movements, and so require a great deal of mental attention and effort, or whether they are habitual, or automatic, or reflex movements, and so play a less and less vivid part in consciousness, they are at every stage muscular movements, they are physical movements, and the forms of training or discipline whereby they become so organized that they are performed easier, with less and less effort of will and consciousness, are forms of physical training;—but they are forms of educational discipline as well.

Now in striving to develop power to do, education should be ordered, of course, so as not to hinder the growth of the organs with which the doing is to be performed. We must take into

account, as best we may, the law of growth in its general and larger sense, if the procedures of education are to be safe and sound and not destructive. The laws of growth correspond somewhat to the laws of death. The first thing that we have to consider, aside from the question of age, is the question of sex. From the beginning to the end, taking life as a whole, the female sex has a better expectation of life than the male. That is to say, a generation of females lives longer than a generation of males; more of them last to greater ages. More male children are born, but more* male children are born dead than female. More male children die before they are twenty-four hours old than female children—before they are three days old, a week old, ten days old, thirty days old, one year old, five years old. And the year of age in which the deaths are the least frequent, for the thousand living at that age, is a year or two earlier in the case of the female than it is in that of the male. That is to say, if, instead of using the death-rate, we express the ratio of the living to those dying at each year of age, by what is termed the specific intensity of life, we find that there is a flood-tide of metabolic activity, of nutritional power, of resistance to death, which occurs when death-rates are lowest and specific intensity of life-rates are highest. That flood-tide of resistance to death is also a flood-tide of growth. The ebb-tide of death and the flood-tide of growth fall in the same year, at least in some instances, but in different years for males and females, one to two years apart.

The result of examinations made some twenty years ago by Dr. H. P. Bowditch, on Boston school children, developed the fact that Boston boys and girls have different growth-rates. Similar observations have been repeated many times since on large numbers of school children in different parts of the world. The results of such investigations are in the main confirmatory of Dr. Bowditch's results. Up to the age of ten or eleven, we will say, boys and girls grow at about the same rate, as regards height and weight. Then the girls shoot ahead; the percentage of increase in pounds and inches from year to year being greater in girls than in boys.* The pre-pubertic acceleration of growth

* I find this to be true as regards Boston, Berlin, Norwegian and Swedish children. Whether it be true for children of other nationalities remains to be determined.

is more intense, culminates sooner and finishes sooner in girls than in boys. Now, if the two sexes differ in respect to growth-rates and death-rates in certain years, *e. g.*, ten, fifteen, we have a criterion of the conformity of certain educational procedures to the laws of normal growth and development. The question arises, is it right and fit that we should expect boys and girls to keep pace, stride for stride, in intellectual efforts and pursuits, year by year? Should they be classed simply according to age? Evidently not. If these facts are true, it seems to me that we must protect the boys, if we are to save them alive from the undue burdens laid upon them, *i. e.*, from the undue burdens laid upon them which are better fitted to the shoulders of the girl of that age than to those of the boy At any rate, it suggests the necessity of recognizing such facts as these, and of attempting to order all our educational procedures, whether mental or physical, in accordance with such facts and laws. Education that does not conform to the laws of Nature is a misnomer.

Then there is a law of growth in the separate organs, in the separate mechanisms themselves. For instance, there is a law of growth in the neuro-muscular mechanisms, in the brain, and in the skeletal muscles. If we study the evolution of the organism, we find that the more general and somatic organs, the more general neuro-muscular mechanisms are formed and developed before the more special organs and mechanisms. Hence the general mechanisms should be trained first. The special organs and functions derive their strength and power, to a degree, from having the oldest and first formed—those that are in continuous and general use—properly built up and organized and trained, and the intermediate ones built up and organized and trained in their due measure and relation. There is a sequence in the development of the parts of all complicated mechanisms. Consider, for a moment, the organs which are concerned in producing speech. Speech-stuff is breath drawn in and expelled under the influence of the bellows-arrangement which we have in the chest. The character of voice is given to the stream of expired air in the larynx; the character of articulate speech is given to it in the changes of the mouth cavity. We have here three classes of mechanisms. The one mentioned first, which is

the one concerned with the intake and output of the coarse stream of air, is developed well at birth; this, the breathing mechanism, is the most fundamental of the three. The most peripheral—the organs of articulation are the latest to be developed—and intermediate between the two are the strictly vocal organs, found in the larynx. Now, the parts of the nervous system which represent the movements of breathing, vocal and articulatory muscles, are built up and become functionally perfect and able in a certain order of sequence from the more central and fundamental portions to the more peripheral and accessory portions. If you invert the order of training, and begin by devoting your efforts towards strengthening and developing the most peripheral and accessory mechanisms, and neglect the fundamental and central, you expend energy unwisely, extravagantly, and harmfully. There is a proper time for introducing manual training, finger training, into the curriculum of education; but to be safe and effectual and productive, it should come after shoulder and arm, or back, shoulder and arm-training, if you will. That seems to be the order of develment in manual training.

In speech training, the result of an inverted or an unintelligent system of training the organs of speech is stuttering. Stuttering is a kind of chorea, or St. Vitus' dance, of one or another of the organs concerned in speech production. It is characterized by lack of coördination between the neuromuscular mechanisms which represent the movements of the three sets of organs of which I have spoken. The difficulty may have its seat in the fundamental portion, affecting the diaphragm; or it may show itself in the laryngeal muscles, affecting the voice; or it may be an affection of the lips or tongue.

Stuttering is much more common than many of us suspect. Within a year I have had two censuses made of the school children of Boston, in order to determine the amount of stuttering among them. I find that 0.75 of one per cent of the school children, taking the 65,000 in the city, from kindergarten to normal school, stutter. We find that about three times as many boys as girls stutter. Girls learn to walk earlier and easier than boys; they learn to talk earlier and easier than boys. This is

all correlated, I think, with their better adaptation to the world that they are born into. Their expectation of life during the earlier years of life is higher than that of boys, which is another way of saying that boys, by the ten, or the hundred, or the thousand, cost more. No wonder they are able to get more in the world's market for their services!

But in a way, the incidence of stuttering, this peculiar central nervous disease has a relation to the law of growth and to the law of death. It would appear that the incidence of stuttering is not quite the same for boys and girls. For instance, the girls stutter most, as measured by the percentages, at twelve, boys at thirteen. In the first census, in which five hundred stutterers were reported in about 63,000 children, it was found that the girls stuttered most at 7, 12 and 16, boys at 8, 13 and 16. The maximum stuttering percentages appear to be correlated with the maximum growth percentages and the minimum death percentages. The largest percentage figure for stuttering among Boston girls is found at the age of twelve, or in the year following their year of lowest death-rate; while thirteen to fourteen, the year in which the largest number of stuttering boys is found, is the year immediately following the year of their lowest death-rate. It may be that the greatest susceptibility of each sex to the special neurosis of stuttering is closely related to the condition of the body when its power of greatest resistance to death begins to decline. It is clear that stuttering increases at the second dentition, at the onset of puberty, and again after the period of accelerated growth has ceased.

As to the grades in which stuttering is most frequent: during the kindergarten years, when almost no attempt is made at formal language-training, there is very little stuttering; but during the first and second years of the primary-grade course, the percentages rush to almost their maximum for the whole school course. What does this suggest? To my mind, it suggests that an inverted order or a wrong order of teaching has been employed; that the simple principles deducible from physiology and psychology with regard to the evolution of the nervous system and its parts, of the neuro-muscular mechanisms in the body and their parts, are not recognized; and that through an inverted and unnatural method of instruction the

child who comes there unable, in many cases, to reproduce sounds accurately and easily, is pushed forward too soon, and a mental and physical condition which result in stuttering is produced. I am not able to discover any law of distribution of stuttering in the different schools and districts in the city, based on topography or nationality. I suspect that certain teachers and certain styles of teaching will be found to constitute foci of infection, and that stuttering then multiplies through the predilection of young children to imitate what is odd and noticeable. Because teachers, as a rule, are not trained to recognize and apply the principles of physical training which are involved in their daily avocations, *i.e.*, they are not trained in the professional normal schools to study the organ of speech as a basis for their procedures in teaching language, are not trained to study the hand as a basis for their teaching of writing and drawing and manual training—they are liable to produce blundering and wasteful results.

There is ground for thinking that this view is approximately correct, since experience shows the best results in treating the stuttering habit are reached by those who begin with setting right the primary vice in stuttering—the mismanagement of the breathing. Respiratory gymnastics constitute the first and necessary and requisite step toward making normal speakers of stutterers. This has been proven to demonstration. You will waste your time in attempting to cure stuttering if you neglect the fundamental breathing organs and direct your efforts solely to the more peripheral organs of voice and articulation. First and foremost, secure good breathing by gymnastic exercises, then direct your attention to the vocal and articulating organs, and you can abolish, or rather abate, at least two-thirds of the school-disease of stuttering. There is no mystery involved in stuttering, or in its cure, beyond the plain principles of physiology. One need not waste his time on excursions into the thin inane of Delsartean or elocutionary philosophy in studying the physiology and pathology of speech-production. I have instanced stuttering simply for the sake of showing that the principles of physical education are of necessity involved in the most ordinary educational procedures, and may be used for distinctively disciplinary purposes.

I will not trespass on your time to consider what might be brought out in the same way with regard to the use of the hand —and there is a question whether manual training is properly brought into schools, at the right age and stage of the child's development. But I cannot forbear to express my firm conviction that this class of facts must be considered, and that the study of movements as such is a matter of paramount importance in education, because movements are an index to the constitution and condition of the brain and nerves. So well is this now understood that, in studying "faculty" among 50,000 school children in London, Dr. Warner used what he called "nerve tests." He scrutinized and noted a variety of movements, e. g., movements of the hands or arms, and from the way in which these and other external muscular movements were made, he judged, as he had a right to do, as to the condition, constitution, and health of the parts of the nervous system and brain, which represented, actuated and regulated such movements. I submit that this point of view opens before us a wide, attractive, and productive field; that if we are to bring about the introduction of physical training on its merits,—as anything more than a mere hygienic expedient, than a glorified form of recess, than a happy vent for animal spirits,—we must study it from this point of view, and in this spirit. We must study movements, and the laws by which they are produced and regulated; we must learn all we can as to what the new physiology and new psychology has to teach concerning the constitution, growth and development of the human body, the human brain, and human mind in connection with it: and thereby we shall promote the interests of education, the interests of life, the interests of sanity, the interests of truth.

THE THERAPEUTIC VALUE OF EXERCISE.

By Randolph Faries, M. D., of Philadelphia.

Therapeutics is the most essential branch of medicine, because it treats of the application of remedies and the curative treatment of diseases. There is not a single physician who will deny that exercise exerts a tremendous power over the body; and its therapeutic value, in a great many diseases, is equal to, if not greater than that of drugs. When scientifically prescribed, and by scientifically I mean from a medicinal standpoint, it is capable of producing results which are of inestimable value to the patient. On the other hand, if prescribed empirically, the results may be such that a shattered and maimed condition of the physique will remain ever after, and, in extreme cases, death may follow. The advantage the physician possesses, in prescribing exercise as a remedial agent for his patient instead of a drug, is that he is using a natural means which is physiologic in its character to overcome the diatheses of the body and cure the diseases of it; while if he were to employ drugs he would be using an unnatural force and one usually employed to change pathologic conditions to those of a physiologic or natural state.

The potency of exercise is measured, not simply by prescribing it, but by prescribing it intelligently; that is, by using it when needed and adding to it any auxiliary means such as drugs, pure air, proper and nutritious food, suitable clothing, bathing, water (either mineral or pure in its nature), ventilation, and sunlight. When prescribing exercise the doctor should consider heredity, idiosyncrasies, age, sex, strength of constitution, previous diseases and injuries; also habits and temperament, and should add to these everything which pertains to bodily hygiene.

Few persons know the symptoms of exercise when it is doing good, and still fewer recognize the symptoms which are prodromes to overwork and exhaustion, whereafter disease frequently follows. The symptoms of exercise when correctly applied will be: increase of appetite, increase in bodily weight (training and persons with a great amount of adipose tissue ex-

cepted), bright color of skin, the heart beats are regular and full, there is an increase in pulmonary capacity, the normal sounds will be clear and distinct, the muscles contract more readily and become harder, will power is strengthened if the exercise be a voluntary one, the nerves respond to stimuli more quickly, the different parts of the body assimilate food more readily, accomplishing bodily construction with little or no waste of energy, the sleep is of the soundest and most refreshing kind, the cornea will present a glassy, bright appearance, and the haemaglobin in the blood will be up to the standard or above it, while the reaction of the blood will be normal, i. e., alkaline, and its specific gravity of the proper standard, namely, 1055. If the exercise prescribed be doing harm, the symptoms will be just the opposite of those when good is resulting, and we find: the appetite impaired or lost, bodily weight is decreased, the skin blanched and pale, the cardiac impulse is diminished in force and may be irregular, hypertrophy with dilitation and even valvular disease may follow, the pulmonary air cells become very much distended, if the exercise be one that has called upon the lungs to any great extent, a slight vesicular murmur can be heard upon auscultation, and if the exercise has been one calling for repeated strain one will hear a slight bronchial rale, the lungs will become emphysematous, and this may lead to phthisis, the muscles do not contract quickly nor to their fullest extent, they become flabby and have a doughy feel, a disinclination to work comes on, which diminishes will power, the disposition will become irritable, the nerves respond to stimuli less quickly, food is badly assimilated throughout the body, sleep is supplanted by restlessness and wakefulness, the cornea has a dull appearance, the coloring matter of the blood will be reduced and the reaction of the blood will be acid, which is due to the excessive production and retention of uric acid.

Many physicians prescribe exercise, never dreaming that they are already adding coals to the fire of the disease for which they prescribed it. For example, one physician will tell a patient who is suffering from brain overwork to take riding lessons, forgetting that mental operations are required to learn to sit properly and guide the animal, at first; another will advise bicycle riding, which also requires mental effort. From this

we learn that no voluntary movement should be prescribed for a person suffering with mental trouble, and in fact one may be compelled from the strength of constitution of the patient to begin his or her treatment by first insisting upon an absolute rest in bed.

There is nothing which will add to the usefulness of a life, and be so great a protection from disease, as exercise properly indulged in. By what mechanism does exercise manifest its value as a therapeutic agent? By bringing into play the organs of movement, namely, the brain, spinal cord, the nerves and muscles, which stimulate every part of the human frame by sending new blood to the different parts of the body and carrying old away. Let us analyze the therapeutic value of exercise in reference to brain overwork brought about by study, over-anxiety, and the many moral responsibilities one constantly encounters. When the intellectual organs are taxed for a long period, the brain is kept active, nervous changes are manifesting themselves with lightning-like rapidity in the brain cells, waste products, especially urates and uric acid are produced, combustion increases the cerebral temperature by sending more blood to the part, the strain upon the nervous mass gradually but surely becomes too great, and nervous exhaustions of all sorts follow, and, alas, when it is too late, insanity overtakes the student. Prescribe an involuntary exercise and what will be the result? The blood will be drawn from the brain to the part employed, because wherever there is a movement there we shall find the blood flowing in greater quantities; and in this way we deplete the overcharged blood vessels in the cerebral mass, and in so doing have decreased the temperature of the brain. Further, we have changed the place of the production of waste materials, and in this way have rid the brain of being exposed to their toxic effects. Moreover, the life and death, or production and destruction, of the brain cells has been diminished on account of a smaller amount of blood going to the brain, and no cerebral energy is expended because the exercise is automatic and calls for no stimulation of the will.

The additional point gained, as to the therapeutic value of an involuntary exercise, is that we have eliminated the action of the brain, and have thus conserved just so much nervous

energy, because the spinal cord takes the place of the brain, and the blood goes to this part of the nervous system in greater quantities instead of going to the brain.

Take annother use of exercise and apply it to the brain, where we find a need for it by stimulating the motor centres through the will, in case of infantile palsies, so that we may get the child to endeavor to use its limbs, and frequently we overcome this disease, in a great measure, by using exercise in conjunction with different kinds of apparatus. If the surgeon would not give up in despair, in reference to infantile palsies, but endeavor, by one means or another, to get the child to use its will power, I am sure more numerous and more satisfactory would be the results in such cases. The difficulty often lies in the fact that the child is not shown how to make the best use of the amount of movement he or she has. More attention should be paid to developing the child's will power to work in harmony with the organs of movement, and especially the muscles, instead of allowing it to have its own way and rebel against doing anything which will cause it to exert all the energy it has to move the affected part. By so doing, I am sure the child would learn to use the affected part with a great deal of advantage.

Nervous maladies are found everywhere, and the evil results are too well known by the physician to need any discussion. Could the myriads of men and women who suffer with nervous diseases only know the therapeutic value of exercise, they would exercise enough to bring their shattered bodies back to a state of good health, and would not drag through their daily work and care, eagerly waiting for bedtime to arrive.

Some will say, I have exercised and it has done me no good. Alas, it is too true! But why? Because no medical examination has been sought, no advice from a physician has been asked for, no laws of bodily hygiene have been followed, nothing but spasmodic work has been taken, and in nine cases out of ten the exercise has been taken too violently, too soon after eating, and under the guidance of an empiricist, or, still worse, under no guidance at all.

The therapeutic value of exercise also holds a high place in the public hygiene of our land. Constantly great changes are

being made in the study of medicine—changes which are for the better, and which are of priceless value to our nation. Everywhere sound judgment is beginning to assert itself, and the question of exercise is now recognized as holding a most important therapeutic value throughout our land. The leading educators have been convinced of the value of exercise when therapeutically applied, and have given it its proper place in the curriculum in the institutions with which they are connected.

Dr. S. Weir Mitchell, in his excellent little work entitled, "Wear and Tear, or Hints for the Overworked," page 9, shows conclusively how greatly exercise influences bodily change, and says: "Above all, educational wants are limited in kind and degree, and the physical man, woman and child are what the state most needs." This is because nature must have a good foundation to start with, or man's moral, spiritual, physical and social being will be as naught. If you give nature but half a chance, and apply exercise judiciously to her needs, she will, with little trouble and without detriment, so adjust her springs of action that a most healthful physique will follow. On the other hand, if you apply exercise wrongly to nature, her laws will remain the same, and, instead of being able to change her laws, one will find that the laws change the person who tries to take exercise by burning the candle at both ends, and trouble will positively ensue which will leave the body weakened forever.

Exercise modifies every tissue in our bodies, and the result of the modification will be for good or evil, according to the judiciousness or injudiciousness with which we apply it. It has long been known by physiologists that function makes the structure of every organ and tissue we possess, which is simply saying that the body adjusts itself, or the different parts which control it, by applying movements to its different parts. The integrity of an organ or tissue depends upon the persistence of function, and it is through this persistence that we see muscles kept strong and healthy, the internal organs undergoing changes, joints modified and becoming easily moved, ever changing in structure, and the brain strengthening, enlarging, and modifying its convolutions. If muscular tissue be allowed to remain in a state of repose too long, we find its fibres weak-

ened, because they become clogged up with fat and other materials; the muscle will atrophy, and this influence will be felt by adjoining muscles. Besides this, we find the joints are affected, and their movements are retarded, because they are absolutely dependent upon muscular action, and in extreme cases, where there is a want of action, the bones become anchylosed, in other words, they are ossified, and an immovable articulation is the result. Is not the therapeutic value of exercise beyond measure in such cases, when we know that a joint may regain its function, and the mobility of it be re-established, by using it either actively or passively? Surely, no one will deny this value. Further, let us see what exercise does for the heart and lungs. One must understand what the heart is and what the lungs are before being able to realize what a powerful effect exercise has upon them. Suffice it to say that the heart is a muscle, and the lungs are the organs of perspiration, composed chiefly of elastic tissue, and may be compared to a pair of bellows. Exercise enlarges the muscular fibres of the heart, makes them more elastic, they become firmer and stronger, and it is owing to this change that the blood is driven more energetically through the blood vessels to the different parts of our body. A strong heart has an especial influence over our lungs, because it sends the blood with greater force to the pulmonary capillaries, and relieves us more quickly of breathlessness, by modifying the passive pulmonary congestion which is a concomitant of exercise. The lungs are benefited by exercise by having their air-cells brought into action, causing them to expand, and thus increase in size and strength.

Further, the functional changes which occur during exercise, when scientifically applied, must be regulated by the nervous system, which is the agent that governs every organic function in our whole body. Should there be any disturbance in the nervous system, we immediately find the various organs suffering as to their function, *e. g.*, the slightest injuries to the nerves, spinal cord, or brain, will produce contractions, convulsions, atrophies and paralyses of muscles; the different glands will be affected, and the heart and lungs will also suffer.

It may be inferred that the whole nervous system may be strengthened by exercise, just as muscles are; by this I mean

the number of cells in the brain and spinal cord may be increased by exercise, and the nerve fibres themselves may also be increased in number in just the same way that muscular fibres are. What the limit of increase may be is not known, but it is reasonable to believe that these structures are increased in number, because we know that persons increase as to their will power, and this is undoubtedly due to the nervous vibration taking place in the cerebral cells, produced by different kinds of stimuli. Moreover, Dr. Luys, in his work on "The Brain," has proved that, after a limb had lost its function, certain parts of the gray matter underwent atrophy, which was due to defective action of the motor cells; hence, if such an action can cause a want of development in these cells, it is but fair to conclude that exercise can increase the production and development of these cells. And since the brain is directly connected with the spinal cord, and the spinal cord with the nerves, it is fair to infer that the same development would take place in these tissues also.

Dr. John B. Deaver, in an article read before the Philadelphia society for the advancement of studying the cerebral mass, has shown that the convolutions of the brain were developed by men who had used the arms and legs to a great extent. We also know in idiots the convolutions are very poorly developed, and, in some instances, they are nearly smooth; while, on the other hand, the brains of men who in life were on an intellectual plane much above the average of their fellow-men, have shown convolutions of a most emphatic character. These conclusions point decidedly to the fact that will power may be strengthened by exercise, because the person who is capable of undergoing systematic exercise puts himself or herself through a discipline which constantly requires volition to come into play, and the very habituation to work produces greater energy of will power, which is productive of a moral as well as a physical force in the nature of the person exercising; and not infrequently the moral force thus produced changes a man from an immoral to a moral being, because it is through his exercise that he has developed the qualities of precision, perseverance, courage, decision, forethought, self-control, patience, endurance, unselfishness, and many other qualities. From these we see how great a moral influence exercise has upon the body.

Again, we not infrequently find persons whose very soul engages in the exercise they indulge in and this appeals to their spiritual nature. Hence, it is but fair to conclude that exercise also has a spiritual influence upon mankind. So often do we find persons averse to taking exercise because they are thoroughly conversant with all of its abuses, while they are totally ignorant of its uses. They have heard of one person dying from consumption, brought about by exercise, another from heart disease from the same cause, a third from ruptures of various sorts, a fourth from too long a walk, and so on; and they are right in their belief, that is, that the trouble was started by exercise. But in how many cases did the person seek the advice of a physician at the outset? Not one, I venture to say.

The therapeutic value of exercise exerts a great influence upon cell life, and we find thousands upon thousands of cells of all kinds produced and destroyed by exercise. Exercise not only increases cell production, as I have already alluded to in cerebral diseases, but it also gives greater vitality to every cell in our bodies when scientifically applied. Protoplasm is cleansed and re-cleansed, produced and re-produced by exercise, by being purified while in the blood, and hence a better tissue results, no matter whether it be nervous, muscular, elastic, or osseous; and especially so when everything pertaining to bodily hygiene is added. Moreover, more bodily energy is acquired, and it is also of a more lasting nature when exercise has been used properly, instead of being abused, as it is in many cases. The metabolic changes which are brought about by exercise are the very conditions which sustain the equilibrium throughout our bodies. The selective power of the cell is made more manifest according to the integrity of the mass of protoplasm supplying it. Anything that interferes with, injures or alters the blood current, will change the normal relations between the flow of blood and the tissues supplied, and here we find metabolic changes concerned because they depend upon blood supply and tissue change. If we use exercise judiciously, we may by it bring a perverted tissue back to the normal and re-establish a function which seemed to all intents and purposes lost, and if not lost, at least greatly impaired.

Metabolic changes are affected in many ways; e. g., by a general atonic condition of the vaso-motor system; atheroma of blood vessels; a paretic state of the trophic nerves; a feeble condition of the heart, and by a lack of exercise itself. If we apply exercise to the foregoing condition we may so tone up the system that the existing trouble will disappear, or at least be so greatly benefited that no evil result will follow which would have followed had exercise been omitted. It has long been known that anaemia and leucocythaemia are characterized by changes in the blood which are traceable to a disordered metabolism, and these diseases may be greatly benefited by exercise, especially if nutritious food, attention to hygiene, and some of the preparations of iron be added. Gout, rheumatism, Bright's disease, consumption, heart diseases of all kinds, all kinds of deformities due to muscular action, such as lordosis, scolioses, talipes calcaneus, talipes equino valgus, talipes equino-varus, talipes equinus, talipes valgus, talipes varus, hollow chests, round shoulders, drooping shoulders, a condition where one carries the head forward and downward, feeble-minded children, and hepatic and gastro-intestinal troubles, may be treated by exercise. The value of exercise in gout and rheumatism manifests itself by driving the blood to every part of the body, and in this way all the tissues which are contaminated with an excess of urates and uric acid are bathed with new blood which carries these waste materials to the kidneys for elimination from the body. In Bright's disease the kidneys themselves may receive such a thorough washing by the blood that the patient may receive no end of benefit; but great care should be taken in prescribing exercise for one suffering with this malady, lest too great an action should be called for by the kidneys in the elimination of waste products. Exercise for consumptives may be either active or passive. When it is active, that is, if the patient indulges in it himself, he should always do so under the direction of a physician, so that the disease may be benefited instead of aggravated; if passively, that is, by the treatment of massage, it should be borne in mind that too much rubbing and too long a séance will often be more productive of harm than of good. The course a person suffering with weak lungs should pursue, if engaging in active exercise, should consist of breath-

ing exercises which are productive of long inhalations and long exhalations, movements of all kinds should be indulged in, and these should always keep pace with the amount of strength possessed by the patient, exercise should be taken in the open air as much as possible, bathing should be taken carefully and judiciously. The only rule to go by in regard to bathing is to take the bath one has been accustomed to all their life. Weak hearts and heart diseases are benefited by exercise just as other muscular tissue; but greater care is necessary in the case of the heart because its anatomy is much more complex and its nervous mechanism much more delicate and intricate than that governing other muscles in general, and it is not subject to the same conditions of rest and action that the other muscles are.

In the application of exercise to deformities, the action of the muscles causing the deformities should be known, and also those muscles which act antagonistically; because it will be found that the latter are the ones whose action, when properly understood and used, will correct the existing trouble. Further, the physician, when using any group or groups of muscles to overcome a deformity, no matter whether it be a spinal curvature, a hollow chest, or one of the many forms of deformed feet, should always bear in mind that the development of muscular tissue and stamina is slow, and will often take months, and even years, to affect a cure; and hence he should never despair if, after an apparently fair trial, he has failed. The deformity will be corrected if the physician only has the determination to stick to his work. Feeble-minded children are greatly benefited by exercise, because it not only increases the vital activity of all the tissues in their bodies by increasing the blood supply of every part, but also because exercise may be prescribed which is extremely simple at first, and which may be made more difficult each day until the mind of the child is receiving the severest kind of discipline; in fact, a discipline equal to, if not greater, than that received by any study it may pursue in school. In such a case the exercise is always a voluntary one. In a case where a child is suffering from brain overwork, which leads to nervous debility and exhaustion, if an absolute rest is not essential, the exercise should always be an involuntary one,

or one that does not require mental operations; and, even then, the physician should have the symptoms of fatigue, overwork and exhaustion at his finger ends, so that he may not be censured for doing the child more harm than good, and in order that he may recognize them the moment they. appear, so as to discontinue the prescribed course the child is taking. When the above precautions are not observed, we frequently find typhoid fever resulting, and in some cases a fever presents itself which resembles intermittent; rheumatism may also be produced. If, however, the exercise be stopped, the latter two will disappear.

When exercise is prescribed for liver and digestive troubles, one should endeavor to ascertain a most accurate account of the constitutional effect they are producing upon the patient, and should immediately employ any drug in his possession to conjoin with exercise, and after the case is well under way the drug should be discontinued, but the patient watched very carefully. In this way much valuable time will be gained in curing the case.

In gastro-intestinal troubles we find the appetite failing because the walls of these organs are suffering from paresis, the muscular coats lose their irritability, in consequence of which the functions suffer, and hence the organs grow weaker. Exercise will overcome this when correctly prescribed.

Obesity is a condition brought about by a defective dissimilation of fat, and if exercise be correctly used, adding to it the proper kind of diet, it can be easily remedied. In this way the patient builds up muscular tissue and improves his or her condition by getting rid of the superfluous adipose tissue.

Exercise is of extreme importance in regulating the nutrition in our body, and is indispensable to the maintenance of health. It also tends to bring every condition of our bodies to a state of equilibrium, whereby health is obtained and maintained.

MASSAGE.

Prescription For Scoliosis.

Lying on the back—Double arm extension upward with respiration —times 4 to 6.

Lying prone—Arms midway between flexion and extension.

For the back. { Friction for 3 minutes, Kneading for 5 minutes, Percussion for 3 minutes.

Lying on the back—Kneading of chest for three minutes.

Respiratory exercises. { Apex filling, Lateral expansion of chest, Dorso-ventral expansion of chest.

Lying prone.

For the back. { Kneading for 5 minutes, Friction for 3 minutes.

Rest for 15 or 20 minutes.

EXERCISES PRESCRIBED

With Reference to Lateral Curvature.

	Apparatus.		Times.	Weight.	Movement.
I.	Head Machine, . .		6 to 12	0	III.*
II.	Pulley Weights, . .		10 to 20	0 to 5	First Course.*
III.	Quarter Circle, . .		3 to 10	0 to 2	With Respiration.*
IV.	Double Rings, . .				For Suspension.
V.	Abdominal Table.	Neck rest prone lying Trunk elevation, . . 1 to 4 Supine lying Trunk elevation, . . . 1 to 4 Supine lying R. leg elevation, ... 1 to 4 Supine lying L. leg elevation, ... 1 to 4 Later double leg elevation. Supine lying arms raised sidewise—upward with respiration.			
VI.	Rowing Machine, . .		15 to 60 5 to 15	7 to 15 7 to 10	I.* II.
VII.	Floor Bars.				
VIII.	Running.				
IX.	Bean Bags or Trays carried on head while marching.				
X.	Chest Expander, . .		6 to 12	2 to 5	I.*

*See Sargent's Hand-Book of Developing Exercises.

"SHOULD PHYSICAL EDUCATION IN COLLEGES BE COMPULSORY?"

By Harriet I. Ballintine, Vassar College.

It is generally granted by the majority of thinking people that physical education should have a place in the life of every student, and some course in gymnastics will usually be found in all American colleges.

It is not then, to-day, so imperative to urge the necessity of establishing such a course as to show the importance of placing this department on such a basis that all the physical requirements of the student can be met and the best possible results be obtained by the greatest number. Just how much physical work should be prescribed by the college curriculum, and to what extent colleges should be responsible for the physical training of their students can hardly be decided in a general way, but it can safely be said, especially in regard to women's colleges, that the students have too little of any form of exercise.

If a thorough, systematic and prescribed course of gymnastics is of any value, women most certainly need the benefit of it throughout their college course.

Speaking of gymnastics for girls, it is hardly necessary to say that reference is made to the student of average health and not those in need of medical gymnastics.

A student ought to expect to find in college the best possible advantages in regard to physical as well as mental improvement, although it must be admitted the former are not always appreciated, for, notwithstanding the fact that extensive buildings and gymnastic apparatus hold a conspicuous place in well-equipped colleges, it will often be found that actually only a small per cent. of the students are taking regular gymnasium work. This may be due to the ignorance on the part of the student to what a physical education means, and the consequent neglect of it when the course is optional, and the comparative inferior position that the college gymnasium holds in relation to other departments of required work.

In reference to physical education the same course can hardly be followed in men's and women's colleges, for it is generally recognized that women are a few generations behind men, not only in physical ability but in enthusiasm and interest in regard to their physical development. While gymnastics for college men can safely be made optional, owing to the indifference of women to their physical requirements, until they can be educated to realize the necessity of a normal physique, a physical education for them cannot be wisely left as an "elective."

What can be considered, then, the most effectual method for a college to adopt in order to create and maintain an interest in this line of work?

Of course, for men, athletics have a great influence in promoting physical exercises in all their forms, and the prominent place given to athletics in the majority of colleges has its influence on the students, even those not actively engaged on teams or crews. But women do not have the benefit of these competitive exercises to create such an interest in gymnasium work, and although the subject of an intercollegiate athletic association for women has been agitated to some extent in our leading colleges, at the present day we must look for other measures as a stimulus better adapted to the possibilities of the average woman and less likely to antagonize a conservative public.

Granting that to interest and educate women to appreciate the object of a physical education is one of the first things necessary to make their college gymnastics a success, let us see the obstacles to be overcome in order to accomplish the desired result. There is a natural apathy and lack of interest that, with few exceptions, the majority of women have in regard to the physical advantages offered by colleges. This is not to be wondered at when it is considered that the necessity of acquiring a physical fitness for college work is often totally disregarded in their home and early school life. A girl with mind so trained as to make her enter college at the age of sixteen, has had very little time or thought to devote to her physical development. It is to be regretted that preparatory schools, which could do so much for girls at the very age when they especially need systematic exercise, often totally neglect this important part of a young girl's education, or, at best give only a smattering of

general calisthenics to students in the ordinary dress of the school room, which, under those circumstances, is worse than nothing. To students not educated to recognize the benefits of a systematic course of exercise, and to those having to contend against inherited tendencies toward physical indolence, some other incentive than their own desire for exercise is necessary, for a girl's natural fondness for physical work will usually be found to be in inverse ratio to her need of it, and for these reasons, granting that it is hardly in keeping with the prevailing university spirit of the day, the question of making college gymnastics obligatory seems necessary.

Perhaps the science of physical training is in too early a stage of development to have proved itself worthy, especially in the eyes of college faculties, to rank in importance with other departments of a college, and indeed, to most of those interested in intellectual educational work this would seem a startling innovation. But if the college gymnasium is not a recognized department, it has its effect upon the students in determining their attitude in regard to its importance, and that a department which is of enough significance to command special buildings, apparatus and instructors should receive more than a nominal recognition, seems reasonable.

If gymnasium exercise is required, as in some instances, of freshmen only, this fact in itself will cause the work to be regarded slightingly by many students, and perhaps with sufficient reason, for a work which claims to be educational in its effect and instrumental in promoting physical endurance, which is of such obvious benefit to those engaged in severe mental application to claim this, and yet require the work but one year, only proclaim its inadequacy.

Perhaps, while theoretically the ideal gymnasium should command only voluntary attendance, the present generation have not gone far enough along the line of a higher physical education when students participate in systematic exercise from choice. In physical as in mental training, to obtain the best results, a certain amount of necessary work must be drudgery, although recreative gymnastics are of great importance in their application to students in need of mental relaxation. Physical education is based upon more than gymnastic games and kin-

dergarten methods. A college department depending entirely for support on a teacher's personality and ability to entertain, although these are important factors in regard to its success, cannot hope to reach the ultimate end for which it was established.

Perhaps a brief résumé of some of the leading colleges with reference to their requirements in regard to physical education will best indicate that those having the most experience in this work have decided that in order to gain the most satisfactory results from the gymnasium, some compulsion in attendance is necessary.

Harvard University is an excellent example of what purely voluntary gymnastic work can accomplish. It has been roughly estimated that eighty per cent. of the students to whom the Heminway Gymnasium is available, make use of it, and that over one thousand, more or less, participate in athletics, while as many as one hundred and fifty meet daily for class work.

The gymnasium work of small institutions, and especially women's colleges, can hardly be compared to Harvard and Yale, where physical education has been so thoroughly established and where the students to be interested are *men*.

At Yale there is no compulsory work, excepting for the elective classes, and the weekly attendance for the past season has been over three thousand.

At Johns Hopkins the work is obligatory for undergraduates, although students engaged in out of door sports are allowed to substitute these for practice in the gymnasium. Physical examinations on entrance and during the third or last year of college work are absolutely required, and students before receiving a degree must have their grade books signed by the gymnasium director.

The same plan of work is followed at Bryn Mawr, but while four hours of exercise are required throughout the four years' course, *three* of these hours may be spent out of doors; so that in reality but *one* hour each week of gymnasium practice is required.

At the Woman's College of Baltimore three hours of gymnasium practice each week is demanded of every student throughout the four college years; any student failing to meet

the requirements of this department being conditioned and obliged to come for gymnasium practice daily until the time is made up.

At Chicago University no student can receive her degree unless her record in this department is satisfactory, although this course is not regarded as one of the thirty-six necessary for graduation.

At Wellesley gymnastics are required of the freshmen only, but physical training has been for three years a recognized department on the same plane as the academic work, the director of the gymnasium having power to condition these students, or even require them to take the course over again. The proposed scheme of an out-of-door gymnasium is a most interesting feature in the further development of this department.

At Cornell gymnastics are exacted from resident women students *five* hours each week throughout freshman and sophomore years. For *men*, military drill during fall and spring terms of freshman and sophomore years, and for freshmen, excepting those engaged in shop work, four hours of gymnasium practice each week during the winter term.

At Smith physical training is considered as a regular college department, but obligatory for freshmen and sophomores only, excepting in case of failure, when the work may be required in the junior year also.

At Vassar and Oberlin, although strictly speaking the gymnasium is not a department, the students not being conditioned, gymnastics are obligatory. At Oberlin gymnastics are required until the senior year. At Vassar three hours each week throughout the entire college course, the students being expected to make up all time lost from the work, unless the cause is illness.

Leland Stanford University has adopted the most radical and perhaps, theoretically, the best method in regard to this line of work, for there the department of hygiene and physical training has been established on exactly the same basis as other departments of the university. Gymnastics are elective, and students who register for this course receive credit for the practical gymnasium work as do students for the laboratory or shop work of other departments. The university also offers a

thorough course in the theory and practice of hygiene and physical training, leading to a degree. It has been estimated that about half of the women students register for the practical work.

Perhaps just such a course as the one at Leland Stanford would do more than anything else to impress the students with the importance of the work; but at the present day it would be impossible, in *every* instance, to establish a course of gymnastics on such a basis, and while it has been shown that in some cases purely voluntary work is most satisfactory, the colleges *requiring* the work are in the majority. This may be necessary for the present generation, or until the average college student is better fitted to judge of his physical requirements.

THE TREATMENT OF LATERAL CURVATURE BY GYMNASTICS AND MASSAGE.

DELPHINE HANNA, M. D.

There are various reasons why lateral curvature should be treated by the gymnasium teacher. At present physical education is carried on largely in connection with our schools. The initial stage of lateral curvature—that reached by preventive measures—corresponds to the time spent in elementary education. The stage of development, requiring remedial measures, corresponds to the time spent in secondary or higher education. The number of cases presented to the gymnasium teacher is much larger than that presented to the orthopedic surgeon.

The need of treatment is often not realized by parents, and none would be given in the initial stage—the only time when there is a good prospect that normal symmetry will be entirely restored. Orthopedic surgeons recommend gymnastics for all stages of lateral curvature. The facilities for such treatment are usually much better in the gymnasium than they are in the doctor's office or at home, and the exercises are, as a rule, more regularly taken. The habitual tilting of the pelvis, so common

among women, leads to deformity and to displacements of the internal organs, particularly those of the pelvic cavity. Displacement of the pelvic organs produces disorders which are often cured by keeping the pelvis in a normal position.

The gymnasium teacher can successfully meet the needs of all these cases.

Scoliosis is defined as "a constant deviation of the spinal column or a portion of it to either side of the median line, with resultant distortion of the trunk." Orthopedic surgeons are still in doubt as to the specific microbe of lateral curvature, still there is quite a unanimity of opinion that it is due to superincumbent weight falling on a spine, held in a faulty position, such as dropping on one leg, sitting in a twisted position, sleeping on one side with too high a pillow, sitting on one foot, crossing one thigh over the other, etc.

From early childhood, most girls have heard this oft repeated injunction, "Throw back your shoulders, and stand straight." A line drawn through the center of gravity of the body falls in front of a line between the two ankle-joints. In putting the shoulders in the position unfortunately directed by the parent, more weight is thrown behind this central line of the body; in order that balance may be maintained, a corresponding weight must be carried in front of this central line; this is done by carrying the pubis forward and upward; if the body in this position is supported by one leg, the other is usually abducted in such a manner that the pelvis is tilted from two to five centimeters toward the unsupported leg, and the weight of the body comes over the heel, instead of the ball of the foot.

You now have one of the common attitudes in which the superincumbent weight falls on a column held in a faulty position. The head is not well balanced on the neck, the trunk on the pelvis, or the pelvis on the thighs. The spinal column has lost its normal curves, a position which, if habitually kept, has a deforming power, not only on the spine, but on many organs of the body. In the last one hundred and ninety-eight examinations made by the writer, there were nineteen students, with lateral curvature, who habitually sat on one foot. Not one of these was aware that such a habit had any power in producing asymmetry of the body.

These faulty positions produce a variety of curves, the most common being that in which the bodies of the vertebræ are rotated toward the right in the dorsal region and toward the left in the lumbar, with a high shoulder and hip on the right side; the ribs are unduly prominent at their sternal ends on the left and at their angles on the right. "The stages of scoliosis have been divided into initial stage, corresponding nearly to childhood; stage of development, corresponding to the age from puberty to the completion of growth, and the stage of arrest, usually taking place after the completion of growth." Most of the cases treated by the writer belong to the second class. For convenience of treatment, these cases in the stage of development have been put in three sub-divisions: First—those that are well, whose muscular strength equals or exceeds the average. Second—cases in which the general health is somewhat impaired; usually there is nervous irritability, pain in the back, disordered menstruation, muscular strength below the average, and restricted respiration. Third—cases wearing spinal supports and unable to go without them. The problem of restoring the normal curves is largely one of balance. No two cases are exactly alike, and variations must be made in the treatment of each case. In all three classes, correct methods of walking, standing and sitting must be taught; the instruction must be thorough, persistent and continued for a long time; there must be established in the pupil's mind the essentials of proper balance, the muscular sense must be so developed by observation and practice that the pupil knows by sensation correct positions; these correct positions should be insisted on, not only during the drill hour, but throughout the entire day.

To correct the faulty standing position, previously described, the chest must be balanced farther forward and the hips must recede. The lateral obliquity of the pelvis must be avoided by supporting the body vertically over the leg that bears the weight; the center of gravity must be over the instep, instead of over the heel. To balance the chest forward and the hips back, the pupil should be trained to carry the interclavicular notch high and well forward; then exercises should be given, which will largely increase the mobility of the chest, so that this raising and pushing forward of the thorax may be largely increased.

In an antero-posterior curve, this raising and pushing forward of the sternum raises the ribs and draws them forward from their angles; the lower angle of the scapula recedes with the ribs, allowing the shoulders to assume a better position. In a lateral curve, it draws the ribs forward and upward on the convex side of the curve, and thus has a rerotating power on the vertebræ, as the chest is vaulted upward and forward, the pelvis recedes downward and backward. Practical results are better, when the pupil's attention is directed toward the chest rather than to the pelvis. If attention is paid to the latter, the pupil, while endeavoring to keep the hips well back, often pushes forward at the lower end of the sternum, increasing the antero-posterior diameter of the lower part of the thorax without a corresponding vertical enlargement. An increase in the depth of the lower chest is made at the expense of the spinal column; as one deepens, the other must shorten, and curvature is increased rather than diminished.

A case in point is Miss N., who had conscientiously taken her prescribed exercises, and, it took some time to find out why the treatment had produced no better results. The chest was low, and there was marked lordosis. Careful observation of her, both while doing her exercises and at other times, brought to light the fact that she was making vigorous endeavors to carry the hips well back and none toward raising the chest.

Pupils need individual instruction on the point until the teacher is sure that they are making efforts in the right direction. If well taught, it will do much toward regaining symmetry.

To correct the lateral tilting of the pelvis, the pupils should first learn to balance the body well on both feet. Then various exercises should be given, in which the weight is balanced vertically, first over one foot and then the other. With these should be given slow poising marches, forward and backward, in which the weight is held for an instant on the ball of each foot, endeavoring in all these exercises to develop in the pupil's mind a sense of position. She will then recognize correct attitudes by sensation. Good walking is the maintenance of correct poise at each step, and is obtained by similar exercises.

In the public schools, careful observation of the children, while standing and sitting, will often detect the faulty attitude

that has produced the curve. Correct positions should then be taught and insisted upon. This, added to the regular school drills, will accomplish much, if good form is required in every exercise, and is probably all that can be done at present. In many cases it is all that is necessary; in others, every effort toward symmetry, even if it does not produce a perfect result, may avert serious deformity and is worth the while.

In the stage of development, for those in the first division, pupils who are well and strong and without marked deformity, the regular gymnasium work with a few prohibitions can be given. Their individual work should be selected with special reference to lateral curvature, and careful work should be done on poise.

In the second and third divisions, cases where the general health is impaired, class drills are, as a rule, to be avoided. All these cases need massage and work prescribed to meet the needs of each individual. The effect of fifteen or twenty minutes of massage of the back and chest in these cases is to decrease nervous irritability and relieve pain, particularly that in the sacral region. Circulation is aided, the flow through the capillaries and lymph spaces is hastened, thus bringing more nutriment to the tissues, and carrying away more waste products, causing an improvement in the general condition of the back. The ability to do muscular work is increased; tense muscles are relaxed and stretched muscles contracted. If, as some think, the defective muscles are the intrinsic muscles of the spine, massage will increase their tone where other measures fail. The chest is more mobile after massage and can be more readily moulded into shape.

In selecting exercises for those in the second and third divisions, I have never used exercises that brought pressure to bear on the convexity of the curve, as surgeons still differ, as to where the pressure could be applied. The exercises should be adapted to the strength of the patient and gradually increased. Weak patients, while taking exercise, should have frequent periods of rest in the recumbent position. The postural exercises are the most important. Special attention should be given to respiration. Many patients breathe well while taking their prescribed exercises, but restrict their breathing whenever they

work elsewhere. By observation and care, the patients can learn to do their ordinary work with unrestricted breathing.

The following cases illustrate the method of treatment:

Miss L., aged twenty, came under my care in September, 1891. Sometime in 1884 she had sprained her ankle. After recovery her mother noticed that the left shoulder drooped, and she complained of pain in her back. She was examined by a physician who said there was no curvature. Six months later, she was examined by another physician, who put her into a silicate jacket. This she wore for six months and then a plaster jacket for six months more, then braces of different kinds for five or six years, and was sometimes better and sometimes worse. Physical examination showed a left lumbar and right dorsal curve, rigidity in the lumbar region with marked deformity. The dynamometers showed good muscular strength, still she could exercise only a few minutes without her brace, and was obliged to keep the recumbent position a number of hours a day. Digestion was poor and lung capacity restricted, and there was pain in the lungs and back. She was given massage, drill in poise and gymnastics. The only school work she did was in the art department. Required her to do her free hand drawing with her left hand, a practice she kept up as long as she was under my care. There was a steady gain in health and symmetry from the beginning. It was not until spring, however, that I could persuade her that she could substitute an ordinary corset for her brace and that a constant pain under the right scapula was due to pressure from her brace and not to a diseased lung. She returned in the fall of '92 and had not felt the need of her brace during the summer. She continued to improve during the fall, rested only a short time during the middle of the day. Digestion was good, no pain in the lungs, and marked improvement in symmetry of body. I regret that I have not photographs of these cases to show you. Since the fall of '92 Miss L. has been pursuing her art studies elsewhere. In February of '94 she reported herself well and thought her back quite as straight as when she stopped treatment, and said that she was still keeping up some of her exercises.

Another case is that of Miss B., who was examined in September of '93. She was injured at nine years of age by a stone

falling on her left hip. Was in bed for two months, after which she was obliged to learn to walk. No curvature of the spine was noticed until a number of years later. Then treatment was given, and she wore a brace for three years without improvement. Had been without a brace for the previous year. Examination showed a high dorsal curve to the left and a curve to the right in the lower dorsal and upper lumbar region. There was pain the entire length of the spine. After sitting some time, a numb sensation would start from the spine and extend over the body. This would, at times, be followed by unconciousness. These attacks of unconciousness have occurred as often as once a day and lasted from one to fifteen minutes. The treatment was twenty minutes of massage four times a week, two spray baths, finished by a cold douche of the spine. She had the usual exercises for these cases on three days each week and took the regular class work on two other days. The deformity was not as marked as in the first case, and the response to treatment was much quicker. There was a marked gain in symmetry by the middle of December, and massage was discontinued, The case is still under observation. February 8th she reported herself free from pain in the back, no numb sensations, has had but one attack of unconciousness since the beginning of the treatment.

None of these cases regained normal symmetry. In marked cases an approximation to symmetry and an improvement in the general health is all that can be expected.

To recapitulate:—*In the initial stage*, careful correction of faulty attitudes in addition to the regular drills in gymnastics. *For lighter cases in the stage of development*, special attention to poise and education of the brain center that gives a sense of position. Individual work prescribed with reference to lateral curvature. To this may be added class drills. *For severer cases in the stage of development*, massage, to put the tissues in a condition to respond readily to further treatment. Cold douches along the spine for their tonic effect on the nervous system. Postural treatment combined with gymnastics prescribed to meet the needs of the individual.

OPEN-AIR GYMNASIUMS.

By Elizabeth C. MacMartin, Charlesbank Gymnasium.

The subject of open-air gymnasiums is unique, and of rapidly increasing interest in the East.

Those at the Charles River Embankment, the first in this country, and they are by no means common in England and Germany, may well be called established institutions and no longer experiments. They have proven their utility. They are the natural outgrowth of the introduction of the park system in Boston. First, only beautiful breathing places; then, in 1886, that part of the shore of the Charles River lying between the Craigie and West Boston bridges, a narrow strip of land, about half a mile in length and two hundred feet wide, was laid out with a view to the establishment of gymnasiums for men and women. A very thickly populated district lying on one side accounts for the large attendance they command.

The men's department was opened first, in August, 1889, under the direction of Mr. John Graham, whose wise management soon converted it from a lounging place into an exercise ground, where athletic contests of a high order increased the interest in physical development, and growth in the number of those using the apparatus for systematic exercise was rapid.

Open two-thirds of the year, with the advent of electric lights the second season, the attendance rose from one hundred to one hundred and sixty-nine thousand. (These figures are the number of entries made during the season for the use of the apparatus or grounds, as registered by the turnstile in the lodge.)

The area of the grounds is five hundred by one hundred and fifty feet, the cost of construction about sixteen thousand dollars, while the women's department, opened two years later, and upon which I now alone may dwell, is three hundred and seventy by one hundred and fifty feet in extent, the cost of construction being about twelve thousand dollars. The maintenance for both, one year, was about six thousand dollars.

The women's department is under the supervision of a committee from the Massachusetts Emergency and Hygienic Asso-

ciation, an association comprised of physicians of recognized standing and well-known women, who have had control of the city playgrounds, and who, the first year, paid the expenses, including salaries, while the city took care of the grounds and apparatus. Having demonstrated that great numbers of women and children could be taken care of by kindly methods of personal influence, they told the Park Commissioners that, as the city was taxed for the maintenance of its parks, they thought it not right to ask personal friends for further means to continue its support. The Park Commissioners acceded to the reasonableness of this request, asking the committee to continue in charge.

As you enter the women's department, you pass up through the lodge and turnstile (which enables the attendant in charge to control the going in and out), by the sand courts and beautiful playground, into the gymnasium proper. The apparatus, furnished and put up under the direction of Dr. Sargent, largely German-American, is attached to a large iron frame-work about thirty feet high, and consists of horizontal and parallel bars, flying and traveling rings (the latter being the first set ever put up out of doors), balance swings, giant strides, perpendicular, zigzag and pole ladders, straight and inclined poles, perpendicular and slanting ropes, trapeze, jumping standards, chest-weights, dumb bells, Indian clubs, long and short wands. Around the playground is a cinder running-track, ten laps to a mile.

The gymnasium is surrounded by a board fence (temporary) seven feet high, almost hidden now by the shrubbery, and continued around the playground by barbed wire. At the farther end are sixteen dressing-booths (made after the fashion of an ordinary beach bathing-house), and there are some bathing and dressing facilities in the lodge, but both here and in the men's department they are quite insufficient. Plans have been drawn, however, for model accommodations in this respect.

Seventy-five at a time fill the gymnasium comfortably, and in crowded days they are allowed to exercise an hour and then make way for another detachment. Either the superintendent or an assistant teacher of gymnastics is always in attendance, and although it is impossible to have minute supervision over each one, as soon as signs of delicacy are noticed, or disposition

to use one piece of apparatus to the exclusion of all others, even in a healthy child, they are examined to a certain extent, and this or that exercise prescribed or forbidden. No objection is made to this, as it is understood to be a pre-requisite for active work. We purpose this year making full physical examinations, which has not been done hertofore.

No girls are admitted under nine, and no men or dogs. Boys, up to the age at which they are received in the men's gymnasium, eight years, were allowed in the play-ground last season. Swings and cradle see-saws are provided for the small children. Those from ten to fourteen years of age do the best work, while those older, lacking the agility of greater youth, cannot do what the younger girls so easily and gracefully accomplish. This proves to us the necessity of body building in early years.

The average attendance is over a thousand a day, but we have had as high as twenty-five hundred, and fifteen hundred is not at all unusual.

It is deemed wise to continue the class work and systematic instruction, although it has been shown that class work, irrespective of method, cannot be successful to any great extent in a free public gymnasium, where regularity cannot be controlled.

This instruction consisted of free movements of chest-weights, dumb-bells, wands or Indian clubs, and perhaps the running high jump out on the grass in the play-ground, and some heavy work in the gymnasium, rings or bars, around the running track once or twice, finishing with a modified form of foot-ball, or quoits. A bicycle was provided, and those most proficient in gymnastic work were taught to ride, but it interfered with the use of the track for baby carriages, and was given up for the good of the greatest number.

That too much insistence might not be placed on any one method, the second year a teacher of the Swedish system was introduced and apparatus added, but the children objected to the movements, saying they were the same as they had in school, and that they were tired of them, although they entered with zest into the Swedish games, which contained a gymnastic element.

With the class work came the question of dress. The committee did not feel that gymnasium suits should be given freely, but a few, donated to us, were loaned to the girls. They were not allowed on the high apparatus unless in costume, but the first year we did not insist upon the regulation suit in class. The second year, however, when we did, the attendance fell from sixty classes, averaging twenty-six in a class, and one hundred and one women, singly, or in twos and threes, to forty-three classes, comprising four hundred and fifty-four girls—an average of ten. Fourteen classes, averaging seven in a class, were instructed in the Ling system. Considering that a mere handful were willing to accede to the request for gymnastic dress the first year, the committee thought this an excellent result, showing the wisdom of control by kindly methods rather than aggressive commands. It was laughable to see the efforts to make calico skirts into trousers.

Next in order comes the question of discipline. You will readily see that it must be quite different, with several hundred girls, from that necessary in an ordinary gymnasium. The committee was at the head of the management, and the first year one of them was there nearly every day. They felt that not merely was the question of gymnastic exercise on trial, concerning the desirability of which there could be no doubt, but wished above all things that the same gentle methods, employed so successfully in their play-grounds, should prove as efficacious here. A superintendent was appointed, associated with her an assistant teacher of gymnastics, also a kindergartner, who had the care of the play-ground. Let me see if I can draw a picture for you. In the lodge are children washing their hands, with mothers and their babies looking out of the windows on to the sand-courts and gymnasium beyond. In the sand-courts are little tots with pails and shovels digging in the sand and making pies. In the play-ground are groups of children playing games, rolling hoop and jumping rope, weaving or outlining designs on cards with worsted; perhaps one of the committee reading aloud to them, or singing. In the gymnasium every piece of apparatus is being used, some in original ways, and a long line waiting their turn on the traveling rings.

I should not omit all mention of Sundays. The gymnasium is closed on that day, but the committee felt that it was not in the spirit of the place that the play-ground should not be used, so, as on rainy days, the children come and are provided with books and papers, quietly reading in the lodge and singing, and, if pleasant, down in the play-ground and sand-heaps.

Large baskets of flowers have been received from the Flower Mission, two or three times a week, as also donations of books, toys, games, and gymnasium suits from individuals.

We have found the Park police ever ready and helpful in many ways. An officer is always on the grounds. In addition, the superintendent and her assistant were sworn in as officers, with the power of arrest. Thus far there has been no occasion for this, as the only trouble comes from drunken men creeping into the shrubbery, from which they are speedily removed by the police outside.

The question of ventilation, an all-important one, is done away with, and no cases of infection have been known. The grounds are sprinkled, but not often enough to prevent the escape of impurities. Cases from the hospital and dispensary doctors have been sent to us, marked benefit resulting from the systematic out-door exercise, particularly noticeable in nervous disorders.

Predominating nationalities are Jews, Irish and Negroes, with all sorts and conditions, from the very poorest to the children of the comfortably off—deaf and dumb, and even blind. Probably fourteen years would be the average age.

There have been no accidents in the women's department other than a few falls and bruises, the most common cause of which is the balance swing, and but few of a slight nature in the men's, and no cases of sunstroke. An awning was erected last year, but the location of the gymnasium, its proximity to the river, and the favorableness of the Boston climate, render even this protection almost unnecessary, although it was a great relief from the glare of the sun.

Flooding the running track, and thus providing skating, has met with much success in the winter months.

Plans for similar gymnasiums in other parts of the city have been drawn. Better bathing facilities and arrangements for

continuing the work the year round, are among the immediate designs of the city for the future.

In large cities where space is a consideration, there is probably more health and happiness to the square inch in an open-air gymnasium than in any system of parks and gardens.

In closing, let me quote from the report of the committee: "It should be borne in mind that it was not a special system of gymnastics which was on trial, nor even was gymnastic exercise our chief object. We wished to prove that large numbers of women and children would grow healthier and happier if right in the heart of the city where they lived, there was a beautiful green place, which it would not cost even five cents to reach, where they could spend each summer day."

And from the Park Commissioners: "The success of this enterprise has been not only pleasing, but in a high degree instructive. We believe that the remarkable demonstration of the usefulness of this public service will lead to the same sort of work being undertaken very widely, especially in our poorer districts."

THE FUNDAMENTAL BASIS OF DIFFERENT SYSTEMS OF PHYSICAL TRAINING, AND SOME OF THE COMMENDABLE FEATURES OF EACH.*

By D. A. SARGENT, A. M., M. D.

It is perfectly natural that men who are giving their lives to the development of a great cause, many problems of which are still unsettled, should have their differences of opinion on certain points, and following the evolutionary methods, tend to form themselves into certain sects or aggregations having similar views.

Art, science and religion are passing through their different stages of development, and education, which, in its broadest application embraces them all, will form no exception.

* This address was delivered by Dr. Sargent, as President of this Association, at the meeting held in Chicago, July 27th, 1893, and should have been published in the last Report.

Some one has aptly said that there is some good at the bottom of every form of religion. It may be said with equal truth that there is something good forming the basic principles of every system of physical training.

Let us consider for a moment what some of these fundamental principles are; then we shall perhaps be better prepared to see in just what respect one sect differs from another, and be able to work more earnestly and unitedly, not for this system or that system, but for the advancement of the cause of physical education.

No one who has been accustomed to make physical examinations of the human body can have failed to recognize the infinite variety of forms and figures that are presented to him. No two are exactly alike; all are different in some respects. Should we make a deeper study of the body, we should find the same variations in the brain, heart, lungs, viscera, muscles and skeleton, and the physiologists tell us that this difference of structure, within certain limits, is absolutely necessary in order to support the change of function brought about by change of environment, etc., etc. Notwithstanding this wonderful variation, there are parts that we all recognize as common. No one would mistake an arm for a leg, or a muscle of the trunk for one from the extremities.

Every part of the human organism has had its form, size and characteristics determined by its peculiar function, and the similar performance of these different parts, in different individuals, for generation after generation, has resulted in the grand totality, which we recognize to-day, in the presence of the average man. Looking at man as a muscular machine, we have no hesitation in making the assertion that there is not a single movement that he is capable of making to-day that has not been made thousands and thousands of times before by some of his remote ancestry. The very existence of such groups of muscles as are called flexors, extensors, adductors, abductors, etc., implies that they have performed these peculiar functions for ages. A further experimental study of the relative power of these different groups of muscles, reveals the nature of the work they have performed, and the comparative resistance, and extent of movement that had given them their present size, strength and peculiar shape.

Unless, therefore, we are prepared to admit that man in "form and movement" is not altogether express and admirable, neither the paragon of animals nor the fashion of the gods, unless we are prepared to create a new being with different muscles, nerves, etc., or are willing that the present ones shall become atrophied and withered from disease, we must, from necessity, adhere to the same fundamental movements and exercises in our systems of bodily training that have brought man to his present state of efficiency and supremacy among animated creatures.

In reviewing the life of man upon the earth, it must not be forgotten that four-fifths of this period, according to the latest authorities, is shrouded in darkness; in other words, it is prehistoric. But no student of evolution believes that man's early life was spent in simply considering the lilies of the fields as they grew, or in watching other wonders of the firmament.

All the evidence we have of primitive man implies a constant struggle with natural forces, and with wild beasts and savage foes, that must have severely tested his physical strength and endurance. Those that survived this trying ordeal must have been able to run, jump and swim, to climb, push, pull, wrestle and fight, to hurl stones, wield clubs, and to lift and carry their burden through forest and stream, over rocks and cliffs, to their mountain caves. Within historic times, the progress of civilization has always depended upon the overcoming of material obstacles. Force has met force, and the energy and strength required in clearing forest, breaking up ground, laying out roads, and in building up towns and cities with their myriad trades and industries, have given energy and strength to the masses in return for their efforts. The pioneers of a new country are invariably a hardy people, and few suffer for want of physical activity. As the country becomes settled, division of labor sends some to the fields, others to the workshop, others to the office and desk, and so on through all the diverse methods of employment, until we find men scarcely using muscles and faculties enough to keep them in a healthy condition.

These are some of the circumstances and changes of environment which have led to variation from the normal in the past, and will lead to still further variations in the future. Under such a régime, the muscles become atrophied, the vital organism

becomes enfeebled, and man enters upon a state of physical deterioration. This is exactly what is taking place to-day in our great cities, and among a certain portion of the population in rural communities.

The only remedy is more intimate contact with nature, a return to simpler modes of life, or the universal establishment of artificial methods of physical training.

Many of the rich and well-to-do are solving this problem by having their country homes, and rearing their children in the open air, with woods and fields to roam in, and with horses, guns, balls, bats, boats, bicycles and tennis-courts at command. To the children of the masses, these so-called natural methods of exercise are not always accessible. Athletic clubs and associations open up good possibilities to a few, but the way in which many of them are managed tends to discourage the very class from entering who are most in need of the training obtained by the practice of competitive sports.

Since the masses are deprived by circumstances and environments from participating in the best forms of exercise, it would seem that the best substitutes were those forms which furnish the nearest approach to the natural methods, by which man has been brought through the ages to his present state of development. If walking, running, jumping, swimming, climbing, lifting, carrying, pushing, pulling, throwing, etc., have made man what he is physically, why should we not imitate these forms of movement in our artificial systems of exercise? This is what every nation, that has given any attention to this subject, has done for centuries, and all of our athletic games and gymnasium exercises have grown out of man's natural experiences.

If a Japanese, or a Soudanese, or a Sandwich Islander, has well developed deltoids, we know absolutely that either he or some of his immediate ancestry has been in the habit of raising the arms forwards, sideways, or backwards. Whether the hands contained a spear, a dumb-bell, an Indian club or a boxing-glove, is a matter of little significance, except that a muscle development is quicker where it has resistance to overcome. What is true of the deltoid is true of every muscle in the body. There are a thousand ways and means of developing them, as

exemplified by different races and peoples the world over, but when we come down to ultimate movements, we know that they are limited by flexion, extension, adduction, rotation, etc., etc., and that these are common to all classes, and to all systems of physical training.

Where, then, is the essential difference?

1st. In the selection of movements and exercises for the development of the flexors, extensors, abductors, etc.

2d. In the *manner* in which these various exercises are to be executed.

3d. In the *order* in which they are to be given.

4th. In the *time* to be devoted to each.

5th. In the conditions and circumstances which accompany the exercises.

In the selection of movements and exercises, the choice lies mainly between those without apparatus, such as free movements, calisthenics, dancing steps, walking, running, jumping, tumbling, swimming, etc., and exercises with light portable apparatus, such as dumb-bells, wands, hand rings, balls, bats, hoops, Indian clubs, fencing foils, swords, single sticks, vaulting poles, etc. Then there are exercises with what may be termed fixed apparatus, as pulley weights, bars, horses, swings, ropes, ladders, etc.

All systems of physical training have something in their curriculum which corresponds to free exercise, exercises with portable apparatus, and exercises with fixed or heavy apparatus. The reason for this general division of the subject is based upon the fundamental conditions underlying the development of the body.

One of the principal forces with which mankind is always contending is *gravity*. We are battling with this force from morning until night, yielding to it partially as opportunity offers, to assume a sitting position, and finally yielding to it completely, as we do each night, when we sink to rest in a horizontal position.

But this force not only acts upon the body as a whole throughout the day, but upon each individual part of the body. Thus the head tends to drop forward, the shoulders to round over and droop downward, the back to curve, the chest to be-

come flattened and compressed, the knees to bend, the arch of the foot to break down, etc. This is nature's attempt to seek an equilibrium, and this giving away to gravity is the first evidence of approaching senility, disease and death. The only way that this downward tendency can be overcome is by the constant exertion of muscular force. Thus, if it were not for the efforts of the muscles at the back of the neck, the head would drop forward on to the chest; if it were not for those running up the spine, and on the back of the legs, the body would drop forward on the pelvis. The relative amount of force expended by these muscles is largely dependent upon the weight of the head, trunk and limbs, and upon one's habitual attitude. If any part of the body is thrown out of equilibrium, it severely taxes certain groups of muscles, and calls for an unusual expenditure of force. Hence one of the most important objects that the instructor in physical training has to accomplish, is to give his pupils a proper balance or poise. This implies the training and strengthening of muscles from the sole of the feet to the crown of the head. The best means of attaining this object is by free exercises, calisthenics, Swedish free movements, dancing or balancing steps, etc.

But man has not been able to maintain a footing in the world simply by keeping his poise and standing erect. He has been obliged to wield his weapons of defence, use his tools and implements of labor, and bear his burdens, with his hands, arms or shoulders, while maintaining his poise and walking about on his feet. This necessity of our nature gives rise to the second grand division of physical exercises, as represented in the use of the portable apparatus, such as dumb-bells, Indian clubs, wands, fencing sticks, etc.

But if the superincumbent weight of the body alone tends to make it yield to gravity, this is more likely to be the case where the body has an additional weight to handle. This is especially observed in the peculiar formation of persons who have been accustomed to carry burdens, however light, for any length of time. The tendency is to droop the shoulders, compress the chest, crook the spine, etc.

Even the constant resistance of a great deal of the clothing that we wear tends to bring about the same physical defects.

Compression of the ribs and thorax interferes with the functions of the vital organs, and often limits their capacity, where it does not actually invite disease.

It is of the greatest importance, therefore, to have a set of exercises that tend to open up the chest by increasing all its diameters. This is admirably done by the use of the parallel bars, hanging rings, stall bars, ladders, boms, and other pieces of heavy or fixed pieces of apparatus. The pulley weights and developing appliances afford an excellent means of acting upon the body in any direction, and in this respect they surpass all other apparatus.

The *manner* in which free movements and exercises with and on the apparatus are performed, is a matter of considerable importance. If groups of exercises are selected simply because they are easy, or because they look pretty, or are short, safe and pleasing, or afford an endless variety, the chances are that a great deal of work will be done that is aimless and ineffective. If, on the other hand, the exercises are selected with a view to their physiological effect, and all of the groups are made up with the intention of accomplishing some important purpose, much better results will follow in a much shorter time.

This seems to me to be the radical difference between the French and Swedish schools. I do not think, however, that it is always necessary or advisable to keep the physiological aim of the exercise constantly before the pupil. Groups of exercises may be arranged which are both pleasing and interesting, and none the less effective from a physiological point of view. It seems to me that the combination of these two extremes, which is effected by the Germans, has much to recommend it.

The *order* of exercises, or the order of progression, as it is sometimes called, is a matter which has lately received a great deal of attention.

All are agreed that one set of muscles should be used while another group is resting, that the simple should precede the complex, the easy the difficult, and that violent respiratory and circulatory exercises should be followed by a gradual slowing down of muscular movements. But why a group of exercises corresponding to the Swedish abdominal backward bending, should always come seventh, and alternate side trunk to left and right

bending always come eighth in a day's order, is something which I have not been able to fathom, though I have frequently heard the reasons given. It has always seemed to me a little fanciful, and I cannot read one of the Swedish day's orders without being reminded of the experience of a friend of mine who kept a summer hotel. During the prevalence of la grippe a few years ago, nearly all of his table girls were unable to attend to their duties, and he was obliged to draw upon the service of other parts of the hotel. Among this number was an Irish porter. After some difficulty, he committed the bill of fare to memory and started in to the dining-room. He announced to the first comer what the house was prepared to serve, beginning with bean soup, boiled fish, roast beef, and so on. The guest ordered some roast beef. "Not until you eat your *bean soup*," was the laconic reply. And the proprietor had considerable trouble in making this son of Ireland understand that the order in which he had learned his lesson was not necessarily the way in which it was always to be served.

In the time arrangement of exercises, I think that the Swedes have taught us much that we can afford to incorporate into all our systems. The duplication of the pieces of heavy apparatus, and having all so constructed that several pupils may be working at once, and the passing from the free movements to the heavy exercises, and from the heavy exercises to the free movements again, etc., are admirable arrangements for getting the greatest amount of work out of a class in the least possible time. It must be admitted, however, that nice individual work, which demands assistance, or special attention from the teachers, is sacrificed for the good of the greatest number.

The aims in view and the conditions and circumstances under which the exercises are carried out, in my opinion, mark the greatest difference in the several systems. In this respect fashion often holds sway, and we are all made to feel the influence of fads in physical training, as well as in other branches of education.

If society demands that woman shall be up in graceful attitudinizing, or that her belles shall have backs as straight as boards, and a carriage equally stiff to accompany them, there will be plenty of teachers who will make these specialties their

stock in trade, and endeavor to give their patrons what they want and are willing to pay for. The absurdity to which these society gymnastics can be carried may easily be imagined when such common-place performances as how to breathe, and how to sigh, or how to sit and how to rise make up the curriculum of many so-called teachers of physical culture.

Grace is a very desirable thing for a young lady to possess, but it must never be forgotten that it is more likely to be the outcome of adequate strength, than simply the power to relax antagonizing muscles, though both together are highly essential. Muscular strength cannot be attained except by making muscular exertion, any more than mental strength can be attained without making mental exertion. But many maintain that they do not care to have muscular strength, but want to strengthen the heart, lungs and vital organs, unmindful of the fact that the only way we can influence these organs is through the action of the muscles. Of course the principal object in view will always give coloring to the physical, as well as the mental training.

The persistent effort of the Young Men's Christian Association gymnasiums to revive the ancient Pentalplon, in view of encouraging the all-round development of the body, should meet the hearty approval of all lovers of genuine sport as a means to an end, rather than an end in itself.

Others aim to give grace, suppleness, health, strength, endurance, erectness of figure, obedience to commands, etc. This leads me to say here, as I have often said elsewhere, that in all exercises the qualities at first demanded are the qualities at length acquired. If you wish to give grace, you must give graceful exercises; if skill and dexterity, those that require these qualities; if coolness, courage, and presence of mind, exercises that bring these faculties into play. So in regard to quickness, strength, precision of movement, power of co-ordinating muscular sense, the art of balancing, and a great many other physico-mental qualities. All may be acquired to a considerable extent by the practice of appropriate exercises.

Now, whether the great variety of exercises necessary to give this broad training is essential to the curriculum of an ordinary school or college, is a matter of judgment and perhaps a matter of taste, depending largely upon what one's views are as to the meaning of the term physical education.

Certainly few will deny that those who are preparing to teach physical exercises, should be as thoroughly grounded as possible in a wide range of subjects. Our normal schools of physical training should be as liberal in this respect as normal schools for other branches of training. In my own school, I have broadened the course so as to take in the widest range of exercises, because I find them necessary in order to obtain the best results.

Years ago, when I thought I had a system, I was only teaching mechanical drills, and I had yet to learn that the thing for an instructor to acquire was the art of developing power, and of increasing human faculty. This cannot be accompliished by simply teaching set drills or by elaborating stereotyped day's orders. The first lesson in the art of power is to learn to get all of one's muscles under complete control of the will, then to acquire mastery over one's self in a new element, under new conditions, or on a new piece of apparatus. Learning to swim, skate, sail a boat, box, row, wrestle, ride a horse or a bicycle, climb a rope, circle a bar, swing on the rings, jump over an obstacle, and a hundred more things familiar to you all, are processes in physical education.

But in my own opinion, the fundamental basis of every system of physical training should be a knowledge of the condition of the individual, which can only be acquired through systematic measurements and careful observations of persons of different races, ages, sexes, and circumstances in life.

In order to meet the responsibilities growing out of the knowledge, the teacher must be able to analyze every kind of exercise, to know what muscles and faculties it develops, to know its dangers and its weak points, where it should be supplemented by other exercises, and where it is complete in itself. In a word, the teacher should know enough about all exercises to use them for what they are worth without fear or prejudice.

It is in just this respect that it seems to me we can all be mutually helpful to each other.

No one, who is not afflicted with the insanity of conceit, can think for a moment that a body of men, who have been working along certain lines of physical training for years, will not have acquired knowledge and experiences that those

working along different lines of the same training have missed, though they in turn may have made other discoveries, and acquired other experiences that are equally valuable. To doubt that this must necessarily be so, is to doubt the breadth and scope of human knowledge. It is the realizing sense of the limitations that surround the individual investigator that should make us anxious to compare our ideas and exchange our experiences. In fact, I have always supposed that was the object of an association. In order that we may get into closer sympathy and meet each other in discussion at shorter range, a series of department meetings will be inaugurated this year, which, I hope, will be followed by favorable results.

In my opinion, it is very much to be regretted that we could not also have had this year the beginning of a series of practical meetings in which different kinds of exercises can be exhibited and compared. We had such a meeting in Boston two or three years ago, which did more to popularize our work and make the association known to the public, than anything which had been done before or has been done since.

And here I must beg to remind those who are opposed to the practical exhibits, that the larger portion of the members of the association are actually earning their salaries by teaching physical exercises, and not by talking and theorizing about them. The papers, however interesting to hear, can always be read and re-read in the official report, but the practical exercises can only be seen to be appreciated. In my opinion, both the theory and practice should be carried along together. Our German friends have given us an admirable illustration during the past week of how this combination may be effected.

When our association fully realizes its importance, we shall be in a better position to popularize gymnastics without detracting in the least from their educational value. Let us hope that a department for the illustration of floor work will be established this year, and that henceforth any individual, or group of individuals, representing one system or a combination of systems, may be encouraged to exhibit in practice what we have so long labored for in theory.

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A. F. Adams, B. A., U. S. Nat'y Museum, Washington, D. C.
Chas. E. Adams, M. A., M. D., 7 West Broadway, Bangor, Me.
Mary E. Allen, Allen Gymnasium, Boston, Mass.
L. W. Allen, Y. M. C. A., Rochester, N. Y.
Amelia J. Allen, 1412 N. 13th street, Philadelphia, Pa.
Henry S. Anderson, Yale Gymnasium, New Haven, Conn.
Wm. G. Anderson, M. D., Yale University, New Haven, Conn.
Miss N. L. Anderson, 191 Warren avenue, Boston, Mass.
E. H. Arnold, M. D., 15 Wall street, New Haven, Conn.
Albert Austin, 106 W. 42d street, New York.
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Lucy J. Anderson, River Falls, Wis.
Alice Anguin, 53 Waban Park, Newton, Mass.
W. E. Allen, Y. M. C. A. Training School, Springfield, Mass.
Lillian F. Armstrong, 40 East Montcalm street, Detroit, Mich.
Emma H. Babcock, St. Margaret's School, Waterbury, Conn.
Maud May Babcock, B. C., 49 West Temple street, Salt Lake City, Utah.
Anna D. Badlam, 64 Bowdoin street, Dorchester, Mass.
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L. K. Baker, M. D., W. and J. College, Washington, Pa.
W. H. Ball, Jr., Y. M. C. A., Montreal, Canada.
Mary Wood Ballard, 1319 N. 15th street, Philadelphia, Pa.
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Jessie H. Bancroft, Director Physical Training, Public Schools, Brooklyn, N. Y.
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Helen O. Barnjum, McGill University, Montreal, Can.

Gazella Bennett, Perkins Institute, South Boston, Mass.
Johan Bentzel, 1823 Arch street, Philadelphia, Pa.
Senda Berenson, Smith College, Northampton, Mass.
W. D. Berry, Center College, Danville, Ky.
Carl Betz, 430 Bellefontaine avenue, Kansas City, Mo.
Henry G. Beyer, M. D., Ph. D., U. S. Naval Academy, Annapolis, Md.
Mrs. Emily M. Bishop, Pratt Institute, Brooklyn, N. Y.
Mrs. Mary T. Bissell, M. D., Berkeley Ladies' Athletic Club, New York.
Chalfant E. Bivens, 2001 Race street, Philadelphia, Pa.
W. O. Black, L. S. Jr. University, Palo Alto, Cal.
R. Winifred Blake, 2116 Mervine street, Philadelphia, Pa.
H. B. Boice, M. D., State Normal School, Trenton, N. J.
Francis Boice, 102 N. 19th street, Philadelphia, Pa.
Jakob Bolin, 332 W. 28th street, New York.
T. P. Bond, Y. M. C. A., Armory Hill, Springfield, Mass.
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Herman Boos, Turnverein, Boston, Mass.
Mrs. S. M. Brearley, Rahway, N. J.
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Zue H. Brockett, 1335 North street, N. W., Washington, D. C.
Ella L. Burbank, Brimmer School, Boston, Mass.
Stella M. Burnham, 286 Brush street, Detroit, Mich.
Carrie E. Byers, 3500 N. 6th street, Des Moines, Ia.
A. Wakeling Ball, Frankford, Philadelphia, Pa.
Clara E. S. Ballard, 631 State street, Madison, Wis.
Percy A. Barlow, Lapeer Private Gymnasium, Lapeer, Mich.
Josephine Beiderhase, 138 W. 104th street, New York.
T. Bessing, State Normal School, Los Angeles, Cal.
Wm. Wheeler Bolster, Jr., Bates College, Lewiston, Me.
Frances N. Boynton, Ogontz School, Ogontz, Pa.
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Lizabeth B. Barrows, The Western, Oxford, Ohio.
Inez J. Blood, 5 Tilley street, New London, Conn.
Blanche A. Bemis, 581 Cambridge street, Allston, Mass.
Helen L. Blackwell, 12 Somerset street, Boston, Mass.
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James A. Babbitt, B. A., Haverford College P. O., Pa.
Alice Virginia Broaddus, Champaign, Ill.
Emma L. Call, M. D., 415 Boylston street, Boston, Mass.
Augusta P. Canby, Oak Lane, Philadelphia, Pa.
Marien F. Carter, Dr. Savage's Gymnasium, New York.

Walter Channing, M. D., Boston, Mass.
Anna B. Chidester, Orchard street and N. 45th, Tacoma, Wash.
R. A. Clark, M. D., Int. Y. M. C. A. Training School, Springfield, Mass.
C. O. Louis Colin, 9 Appleton street, Boston, Mass.
Eugenia Conant, 102 Pearl street, Burlington, Vt.
Thos. Cornelius, Y. M. C. A., Baltimore, Md.
Harry S. Cornish, Chicago Athletic Association, Chicago, Ill.
Miss Alberta Josephine Cory, Oberlin College P. O., Ohio.
Annie N. Curtis, 428 Jackson street, Milwaukee, Wis.
Florence Cushman, St. Agnes School, Albany, N. Y.
Alice M. Cutter, 9 Auburn Place, Brookline, Mass.
Lucy C. Catlin, 505 West State street, Jacksonville, Ill.
Sara E. Coates, B. A., 55 E. 2d street, Portsmouth, Ohio.
Helen L. Coe, 450 Cumberland street, Portland, Me.
Wm. H. Corey, 11 Stone street, Charlestown, Mass.
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Kate Van R. Coburn, 117 Park street, New Haven, Conn.
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C. E. Caswell, Y. M. C. A., Houston, Texas.
Grace Tileston Clark, 93 Warren street, Roxbury, Mass.
Chas. H. Carey, Y. M. C. A. Training School, Springfield, Mass.
John A. Collins, 43 Euclid avenue, Detroit, Mich.
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Eleanor R. Deane, 282 Huntington avenue, Boston, Mass.
W. B. Dickinson, Y. M. C. A., Albany, N. Y.
F. H. Dodge, Chicago Athenæum, Chicago, Ill.
D. L. Dowd, 9 East 14th street, New York.
Frank W. Durkee, A. M., Tuft's College, Massachusetts.
Louise E. Dutcher, 117 Gates avenue, Brooklyn, N. Y.
Janet E. Day, 101 South 3d street, Janesville, Wis.
Adam Doehla, 216 Shaw avenue, McKeesport, Pa.
Weltha Alice Darby, Meadville, Pa.
Wm. B. Durand, Y. M. C. A. Training School, Springfield, Mass.
H. L. Dietz, Springfield, Mass.
Katherine E. Eaton, 220 Lexington street, East Boston, Mass.
Christian Eberhard, Boston Athletic Association, Boston, Mass.
C. E. Ehinger, M. D., State Normal School, West Chester, Pa.
George W. Ehler, Y. M. C. A. Training School, Chicago, Ill.
L. D. Eldredge, Athletic Association, Rochester, N. Y.

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Fred O. Ellis, Norcross School, Boston, Mass.
Harriet B. Ells, Vassar College, Poughkeepsie, N. Y.
Claes J. Enebuske, A. M., Ph. D., 9 Appleton street, Boston, Mass.
Max J. Exner, Carleton College, Northfield, Minn.
Grace J. Easton, 120 Broadway, New York.
Franz Eger, Holyoke Turnverein, Holyoke, Mass.
J. C. Elsom, M. D., Y. M. C. A., Minneapolis, Minn.
Mary P. Evans, 934 South street, N. W., Washington, D. C.
Mrs. C. E. Ehinger, West Chester, Pa.
Eva Egbert, Franklin, Pa.
Elizabeth L. Farnsworth, 195 West Springfield street, Boston, Mass.
William Findley, 1009 Arch street, Philadelphia, Pa.
Mrs. Miriam Findley, 1009 Arch street, Philadelphia, Pa.
Frederick A. Finkelday, 218 Walnut street, Philadelphia, Pa.
Geo. W. Fitz, M. D., Harvard University, Cambridge, Mass.
Grace E. Fogler, Hotel Oxford, Boston, Mass.
Anna G. Foley, 26 Mulberry street, Worcester, Mass.
W. A. Ford, M. D., 1420 Chestnut street, Philadelphia, Pa.
P. L. Foss, Y. M. C. A., Bay City, Mich.
Alice B. Foster, M. D., Bryn Mawr, College P. O., Pa.
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Walter Andrew French, 321 Pine street, Lewiston, Me.
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Nellie A. Foglesong, 327 E. Main street, Dayton, O.
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W. H. Gebhardt, Y. M. C. A., Racine, Wis.
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J. T. Gibson, Agassiz School, Jamaica Plain, Mass.
Frank M. Gilley, 100 Clark avenue, Chelsea, Mass.
Alice D. Gilman, 12 Baldwin street, Newton, Mass.
Carrie Goldsmith, 387 W. 4th street, Cincinnati, O.
Bessie F. Gordon, Arlington, Mass.
Alice M. Gray, 39 Barrington street, Dorchester, Mass.
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Edward F. Gage, A. B., Harvard Medical School, Cambridge, Mass.
Martha Garside, 715 Pacific street, Atlantic City, N. J.
H. L. Green, Y. M. C. A., Findley, O.
Frances D. Guion, Elmira College, Elmira, N. Y.

Jas. T. Gwathemey, M. D., Nashville, Tenn.
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Grace M. Gilman, 22 Home avenue, Indianapolis, Ind.
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W. S. Hall, M. S., M. D., Haverford College P. O., Pa.
Alfred T. Halsted, Ph. G., M. D., Springfield, Mass.
Ida R. Hamaker, 39 Green avenue, Brooklyn, N. Y.
Delphine Hanna, M. D., Oberlin College, Oberlin, O.
Samuel Harrington, Eliot School, Boston, Mass.
Corinne Harrison, 28 College Place, Norfolk, Va.
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W. E. Hoffman, Y. M. C. A., Wilmington, Del.
Vendla M. Holmstrom, Posse Gymnasium, Boston, Mass.
Amy Morris Homans, 9 Appleton street, Boston, Mass.
Edgar S. Holt, M. D., 47 W. 63d street, New York.
Maude G. Hopkins, Drexel Institute, Philadelphia, Pa.
Geo. W. Hoskins, State College, Center Co., Pa.
Grace H. Howes, 589 Dudley street, Roxbury, Mass.
John A. Howland, Y. M. C. A., Providence, R. I.
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Millicent Humpston, 547 West Front street, Plainfield, N. J.
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Edith B. Hammond, 5614 Madison avenue, Chicago, Ill.
A. B. Harper, 724 Cherry street, Vicksburg, Miss.
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Jennie E. Ireson, 185 West Canton street, Boston, Mass.
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Henry Metzner, 212 E. 83d street, New York.
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Nina J. Moses, 17 Ellis street, Roxbury, Mass.
Eliza M. Mosher, M. D., 196 Joralemon street, Brooklyn, N. Y.
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W. A. McCulloch, 35 North Illinois street, Indianapolis, Ind.
B. B. McElhany, Y. M. C. A., Dayton, O.
Mary V. Mitchell, M. D., 2310 North Calvert street, Baltimore, Md.
Henrietta Moore, O. B., 117 Edmund place, Detroit, Mich.
Henrietta A. Murray, 66 Jacques avenue, Worcester, Mass.
Martha E. Maccarty, 1612 Green street, Philadelphia, Pa.
Eva G. May, State Hospital, Rochester, N. Y.
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Frances S. Noyes, Dansville, N. Y.
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Gulli Oberg, Woman's College, Baltimore, Md.
Edward O. Otis, M. D., 93 Mt. Vernon street, Boston, Mass.
Mrs. S. K. O'Neil, School of Physiology, Minneapolis, Minn.
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H. S. Pettit, M. D., Adelphi Academy, Brooklyn, N. Y.
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Carrie B. Palmer, 213 Orman street, Pueblo, Col.
Edw. A. Pennock, 936 Franklin street, Philadelphia, Pa.
Frank Pfister, 866 Lorain street, Cleveland, O.
Lillian L. Pike, North Denver High School, Denver, Col.
Geo. F. Poole, M. D., School Christian Workers, Springfield, Mass.
Laura L. Pratt, M. D., 33 Auburn street, Malden, Mass.
P. S. Page, Y. M. C. A. Training School, Springfield, Mass.
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C. A. Rabethge, Friends' Gymnasium, 140 N. 16th street, Philadelphia, Pa.
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Hans Rasmusseer, 193 Lloyd street, Milwaukee, Wis.
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Mary A. Roberts, Southern Illinois Normal University, Carbondale, Ill.
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Caroline Alfarata Ruble, 52 North avenue, A., Canton, Ill.
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Josiah P. Ryder, Drexel Institute, Philadelphia, Pa.
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Mary L. Sage, 405 N. 32d street, Philadelphia, Pa.
Frances S. Sanborn, Mt. Holyoke College, South Hadley, Mass.
D. A. Sargent, A. M., M. D., Harvard University, Cambridge, Mass.
W. L. Savage, M. D., 308 W. 59th street, New York.
Ellen C. Sawtelle, Hancock School, Boston, Mass.
H. L. Sawyer, Bennett School, Boston, Mass.
Edward M. Schaeffer, M. D., Room 400, Equitable Bldg., Baltimore, Md.
J. A. R. Scott, 223 North avenue, North Cambridge, Mass.
Jay W. Seaver, A. M., M. D., Yale University, New Haven, Conn.
F. N. Seerley, M. D., Int. Y. M. C. A. Training School, Springfield, Mass.
George Seikel, 158 Court street, Newark, N. J.
Isabelle Seymour, Woman's Medical College, Philadelphia, Pa.
J. Kurzer Shell, M. D., Swathmore College P. O., Pa.
M. H. Sheriden, Y. M. C. A., Birmingham, Conn.
Mrs. J. W. Shoemaker, 750 N. 19th street, Philadelphia, Pa.
Otis C. Skeele, Posse Gymnasium, Boston, Mass.
May D. Small, 2001 Race street, Philadelphia, Pa.
Caroline W. Smedley, 4661 Penn street, Frankford, Pa.
J. Gardner Smith, M. D., Harlem Branch Y. M. C. A., New York.
L. B. Smith, Y. M. C. A., Cincinnati, O.
Fannie M. Smith, 833 Main street, Racine, Wis.
Fanchon W. Smith, 1325 Chestnut street, Oakland, Cal.
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C. W. Smith, 4 N. 40th street, Philadelphia, Pa.
Joseph I. Smith, 207 N. 5th street, Philadelphia, Pa.
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Grace E. Spiegle, 2115 N. 12th street, Philadelphia, Pa.
Mary L. Squier, 816 K. street, Washington, D. C.
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A. Alonzo Stagg, University of Chicago, Chicago, Ill.
G. D. Stahley, M. D., Pennsylvania College, Gettysburg, Pa.
William A. Stecher, 1830 Papin street, St. Louis, Mo.
Emma S. Stillwell, 1600 Arch street, Philadelphia, Pa.
A. P. Stockwell, Y. M. C. A., Melbourne, Australia.
James Farrar Stone, M. D., 1808 Green street, Philadelphia, Pa.
Lorena Stone, Miss Armstrong's School, Cincinnati, O.
Rebecca Stoneroad, 1123 13th street, Washington, D. C.
Sina Stratton, Media, Pa.
Henry Suder, 1619 Grace street, Chicago, Ill.

Abbie W. Sullivan, 23 Winthrop street, Roxbury, Mass.
Fremont Swain, M. D., 120 E. 86th street, New York.
Anton Schatzel, Islip Athletic Association, Islip, L. I.
Henry S. Sauerbrey, Y. M. C. A., Owatonna, Minn.
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John N. Tilden, M. D., Military Academy, Peekskill, N. Y.
J. Toensfeldt, 912 S. 9th street, St. Louis, Mo.
Lizzie G. Tompson, Newtonville, Mass.
Cordelia C. Torrey, 23 Winthrop street, Roxbury, Mass.
Jennie S. Tower, 128 Pembroke street, Boston, Mass.
Lillian M. Towne, Charlestown High School, Boston, Mass.
Harriet E. Turner, Institute for Blind, Indianapolis, Ind.
M. Ada Turner, Stoughton, Wis.
Sara May Taylor, Winslow, Me.
Mrs. Ella P. Upham, M. D., 304 3d avenue, Asbury Park, N. J.
F. P. Valdez, Y. M. C. A., Charleston, S. C.
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Annie Wade, Columbus, Miss.
Florence C. Walker, St. Margaret's School, Buffalo, N. Y.
Col. Joseph R. C. Ward, 1905 Fairmount avenue, Philadelphia, Pa.
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Mrs. Harvey C. Went, Bridgeport, Conn.
H. D. Wey, M. D., State Reformatory, Elmira, N. Y.
Frank N. Whittier, M. D., Bowdoin College, Brunswick, Me.
William F. Wickersham, Westtown, Pa.
Alice M. Williams, 43 Ingell street, Taunton, Mass.
Ursula M. Willard, Barton, Vt.
Mary Willits, A. B., Friends' School, Wilmington, Del.
Almira J. Wilson, 34 Berkeley street, Boston, Mass.
M. Caroline Wilson, Nonantum Gymnasium, Newton, Mass.
Jennie B. Wilson, Sanatory Gymnasium, Cambridge, Mass.
Katherine Wilson, 107 N. 15th street, Portland, Ore.
Magnus F. Winter, Hoboken Turnverein, Hoboken, N. J.
Fannie H. Wiswall, Boston School of Oratory, Boston, Mass.
M. Anna Wood, M. D., Wellesley College, Wellesley, Mass.
C. M. Williams, Temple College, 1831 Arch street, Philadelphia, Pa.

T. D. Wood, M. D., L. S., Jr., University, Palo Alto, Cal.
Elizabeth A. Wright, Smith College, Northampton, Mass.
Elizabeth M. Wright, Pennsylvania College, Pittsburg, Pa.
Katherine Westendorf, School of Elocution, Linton street, Cincinnati, O.
Alta Wiggins, 254 E. 3d street, Salt Lake City, Utah.
Mary Elvira Wilder, 1142 Lawndale avenue, Chicago, Ill.
Ethel Rubie Weeden, 35 Whalley avenue, New Haven, Conn.
C. E. B. Wall, Y. M. C. A. Training School, Springfield, Mass.
Louis Welznille, Jr., Springfield, Mass.
Millie Weicksel, Line Mountain, Pa.
Margaret S. Wallace, Newtonville, Mass.
Flora White, Westfield, Mass.
Evaline Young, Girls' High School, 2046 Park avenue, Philadelphia, Pa.
Karl Zapp, 171 Scoville avenue, Cleveland, O.
Aug. Zapp, 488 North Hayne avenue, Chicago, Ill.
Carl Ziegler, 532 Bishop street, Cincinnati, O.

ASSOCIATE MEMBERS.

Jessie Richards Adams, 28 Winniemay street, Natick, Mass.
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Edward E. Allen, M. D., Penn. Institute for Blind, Philadelphia, Pa.
Harlan P. Amen, Riverview Academy, Poughkeepsie, N. Y.
Lewis Bacon, 9 Park street, Boston, Mass.
Lewis H. Bacon, 65 Wareham street, Boston, Mass.
Mabel H. Barrows, 51 Sawyer avenue, Dorchester, Mass.
Lena Bateman, 462 Classon avenue, Brooklyn, N. Y.
Edward Bettle, Jr., 514 Walnut street, Philadelphia, Pa.
J. B. Bisbee, M. A., Riverview Academy, Poughkeepsie, N. Y.
Kenneth M. Blakiston, 1012 Walnut street, Philadelphia, Pa.
Franz Boas, Ph. D., Clark University, Worcester, Mass.
Joseph Boms, Providence, R. I.
E. H. Bradford, M. D., 149 Newbury street, Boston, Mass.
Chas. E. Briggs, A. M., M. D., 2747 Olive street, St. Louis, Mo.
Mrs. Belle S. Bruce, 155 South Broadway, Yonkers, N. Y.
Louis A. Bull, M. D., 665 West Ferry street, Buffalo, N. Y.
F. W. Burkhardt, Int. Y. M. C. A. Training School, Springfield, Mass.
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Jotham F. Black, 29 Howard street, Springfield, Mass.
Franklin Carter, LL. D., Williams College, Williamstown, Mass.
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Elizabeth Lawrence Clarke, Williams College, Williamstown, Mass.
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Edmund Cobbe, M. D., 2125 Arch street, Philadelphia, Pa.
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S. W. Dodds, M. D., 2826 Washington avenue, St. Louis, Mo.
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Thomas Elkinton, 119 S. 4th street, Philadelphia, Pa.
Jessie Fremont Emery, 24 Columbia street, Dorchester, Mass.
Adella F. Fay, 20 West avenue, Buffalo, N. Y.
Festus H. Foster, Jr., 53 Union street, Springfield, Mass.
John Forrest, M. D., 10 King street, Charleston, S. C.
William F. Garcelon, 384 Main street, Lewiston, Me.
Merrill E. Gates, LL. D., Amherst College, Amherst, Mass.
Edith Sabbott Gould, West Newton, Mass.
J. F. Gray, 1126 Market street, Philadelphia, Pa.
Alma L. Greene, Chestnut, cor. Hall street, Waltham, Mass.
Alliston Greene, Westboro, Mass.
H. Laussa A. Geyelin, 217 Gwais Building, Philadelphia, Pa.
Rose Marie Gyles, Dodge City, Kan.
James A. Greenwald, Y. M. C. A. Training School, Springfield, Mass.
Jonathan C. Hall, M. D., Friends' Asylum, Frankford, Pa.
Mrs. J. C. Hall, Friends' Asylum, Frankford, Pa.
Simon Hart, Newport, R. I.
James W. Hartigan, A. M., M. D., Morgantown, W. Va.
C. E. Haskell, Y. M. C. A., Cambridge, Mass.
C. E. Hastings, M. D., 160 Huntington avenue, Boston, Mass.
C. M. Hazen, A. M., 1001 Main street, Richmond, Va.
Annie J. Hewins, High street, Dedham, Mass.
Mrs. Mary Dana Hicks, 7 Park street, Boston, Mass.
M. L. Holbrook, M. D., 46 E. 21st street, New York.
Jacob F. Holt, M. D., 1935 Poplar street, Philadelphia, Pa.
Marian Hovey, 100 Beacon street, Boston, Mass.
Mary Hubbard, The Warren, Roxbury, Mass.

Kathryn Hubbell, Urbana, O.
May H. Hutchins, 240 Marlboro street, Boston, Mass.
Frank Holman, Springfield, Mass.
Lilla D. Ide, 389 Ashmont street, Ashmont, Mass.
Sarah J. Jacobs, 11 Thornley street, Dorchester, Mass.
Rebecca R. Joslin, 71 Charles street, Boston, Mass.
Mrs. Thomas S. Kirkbride, 1406 Spruce street, Philadelphia, Pa.
H. E. Knapp, 1414 Arch street, Philadelphia, Pa.
Elizabeth S. Kurtz, 273 Chaplain street, Detroit, Mich.
Rebecca Kite, 3322 Hamilton street, Philadelphia, Pa.
L. Lanier, 2011 3d avenue, Birmingham, Ala.
Nina M. Lee, 108 Stockton street, Trenton, N. J.
D. F. Lincoln, M. D., Hobart College, Geneva, N. Y.
G. Wilds Linn, A. M., M. D., Bryn Mawr, Pa.
Sophie E. Luttgen, 13 Monroe street, Warren, O.
James Lyman, Middlefield, Conn.
Mrs. James Lyman, Middlefield, Conn.
Helen Saunders Lathrop, 17 Angell street, Providence, R. I.
Fred A. Luce, Cambridge, Mass.
John W. Lutz, Springfield, Mass.
R. R. McBurney, 40 E. 23d street, New York.
R. McCastline, Int. Y. M. C. A. Training School, Springfield, Mass.
Samuel S. McClure, Tribune Building, New York.
Charles McIntire, Jr., M. D., 104 N. 4th street, Easton, Pa.
B. E. McKenzie, M. D. Bloor street, East Toronto, Can.
Esther M. McPherson, 408 N. 41st street, Philadelphia, Pa.
May E. Maffitt, 336 Dudley street, Roxbury, Mass.
Ida Martin, Carrollton, Miss.
Gen. E. L. Molineux, 117 Fort Greene Place, Brooklyn, N. Y.
Oliver C. Morse, 219 Florida street, Springfield, Mass.
F. F. Murdock, Bridgewater, Mass.
Lucie Bianca Muller, Chattanooga, Tenn.
Alice Marshall, 233 York street, New Haven, Conn.
Edward S. Moulton, A. M., M. D., 233 York street, New Haven, Conn.
Wm. G. Morgan, 12 Shattuck street, Springfield, Mass.
Rufus J. Martin, Y. M. C. A. Training School, Springfield, Mass.
Carlos Montezuma, Carlisle, Pa.
Mary B. Moody, M. D., Fair Haven Heights, Conn.
Silas S. Neff, 1414 Arch street, Philadelphia, Pa.
William E. Ninde, 19 Franklin street, Providence, R. I.
Rev. Jinzo Naruse, Theological Seminary, Andover, Mass.
Henry K. Oliver, M. D., 12 Ashburton place, Boston, Mass.
Carrie S. Osgood, Hoffman House, 212 Columbus avenue, Boston, Mass.
Lawrence A. Oller, Y. M. C. A. Training School, Springfield, Mass.
Nina A. Page, 9 Appleton street, Boston, Mass.
Caroline E. Page, 223 Pleasant street, Boston, Mass.
Francis W. Parker, 6640 Honore street, Englewood, Ill.

Eleanor Parry, 202 W. 74th street, New York.
Addison B. Poland, State Supt. Public Instruction, Trenton, N. J.
C. M. Pratt, Pratt Institute, Brooklyn, N. Y.
F. B. Pratt, Pratt Institute, Brooklyn, N. Y.
Frank P. Partridge, 109 North avenue, Cambridge, Mass.
Ellery G. Peckham, Stamford, Conn.
Baroness Rose Posse, 23 Irvington street, Boston, Mass.
Jumes C. Peoples, Y. M. C. A., Charleston, S. C.
Robert Reach, 8th street, Philadelphia, Pa.
E. L. Richards, Yale University, New Haven, Conn.
M. B. Rideout, 14 Rue de Trévise, Paris, France.
L. S. Russell, 201 K. street, South Boston, Mass.
John Francis Rogers, 2981 Archer avenne, Chicago, Ill.
J. C. Reeve, Jr., M. D., Wilkinson and Third streets, Dayton, O.
Isaac Roberts, Conshohockin, Pa.
Ezra W. Sampson, Newtonville, Mass.
Amanda D. Saulsbury, Ridgely, Md.
B. Schlesinger, 131 Devonshire street, Boston, Mass.
C. L. Scudder, M. D., 94 Charles street, Boston, Mass.
O. P. Seward, Y. M. C. A., Elgin, Ill.
Rev. J. W. Shanahan, 48th street and Lancaster avenue, Philadelphia, Pa.
C. F. E. Shulz, 1102 Myrtle avenue, Baltimore, Md.
Ella E. Smith, Canandaigua, N. Y.
Laura C. Snow, 18 Wendall street, Cambridge, Mass.
Fred'k Starr, Ph. D., University of Chicago, Chicago, Ill.
Alice Mae Stevens, 2737 Olive street, St. Louis, Mo.
M. Emma Stubblebeen, 216 Warren street, Hudson, N. Y.
Lura W. Sanborn, Exeter, N. H.
Adela J. Smith, Paulison avenue, Passaic, N. J.
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Francis Edw. Stuart, M. D., Ph. G., The Glen Springs, Watkins, N. Y.
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Mrs. Jay W. Seaver, 233 York street, New Haven, Conn.
Horace A. Tarbell, Supt. Public Schools, Providence, R. I.
Mary Eloise Talbot, 28 Lincoln street, Boston, Mass.
Emilie C. Theis, Springfield, Mass.
George Vaux, Jr., Girard Building, Philadelphia, Pa.
Phoebe Nicholson Votaw, Westtown, Pa.
Isabel Walker, 138 4th street, New Bedford, Mass.
Mathilda K. Wallin, M. D., 21 E. 21st street, New York.
Mrs. Emma N. West, 113 Chandler street, Boston, Mass.
Ruth Ballow Whittemore, 28 Mather street, Dorchester, Mass.
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Elsie Marie Wilbor, 108 E. 16th street, New York.
May Stevenson Wistar, Salem, N. J.
A. L. Wood, M. D., Wawbeck, Franklin Co., N. Y.
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A. G. Young, M. D., Augusta, Me.

REPORT

OF THE

TENTH ANNUAL MEETING

OF THE

AMERICAN ASSOCIATION

FOR THE

ADVANCEMENT OF PHYSICAL EDUCATION

HELD AT

TEACHERS' COLLEGE, NEW YORK, N. Y.,
APRIL 25, 26, AND 27, 1895.

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REPORT OF THE TENTH ANNUAL MEETING

OF THE

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF PHYSICAL EDUCATION,

HELD IN THE

TEACHERS' COLLEGE, 120TH STREET, NEW YORK CITY,

April 25th, 26th, and 27th, 1895.

The Association was called to order, and the meeting opened, at 10 o'clock A. M., at the Teachers' College, and the following programme of exercises was carried out:

THURSDAY, April 25, 1895.

MORNING SESSION.

9:30 o'clock. Meeting of the Council in Professor Woodhull's office.
10 o'clock. Meeting devoted to Anthropometry and Vital Statistics.

COMMITTEE:

Miss Senda Berenson, Dr. Edward Hitchcock, Dr. Jay W. Seaver.

1. The Need of Individual Anthropometry, D. F. Lincoln, M. D.
2. A Diagram of Working Capacity and Resistance, as Manifest in Gymnastic Exercises, C. J. Enebuske, Ph. D.
3. How Boys Grow, Schuyler B. Moon.
4. Bowditch's Law of Growth and What it Teaches, E. M. Hartwell, M. D.
5. Report of the Committee, Edward Hitchcock, M. D.
   Exhibition of Anthropometric Material.

AFTERNOON SESSION.

2 o'clock.

1. Meeting devoted to a Report of the Committee on Bibliography: Dr. Carolyn Ladd Hall, Dr. F. E. Leonard, Dr. E. M. Hartwell.
2. Report of the Committee on the Dewey Decimal System of Classification of Books in Libraries: Dr. E. M. Hartwell, Dr. C. J. Enebuske, Dr. A. T. Halsted.

3 o'clock. General Public Meeting.

1. Address of welcome, and paper, The Relation of Physical Education to Modern Life, Pres. Walter L. Hervey.*

* Omitted owing to illness of Pres. Hervey.

2. The Value of Strength Tests in the Prescription of Exercise, J. H. Kellogg, M. D.
3. On the Physical Processes Involved in the Nutrition of Muscle as Influenced by Alternating Activity and Rest, Jacob Bolin.
4. The Hygiene of Bodily Culture, E. M. Schaeffer, M. D.
5. "The Newcomb," Clara G. Baer.

EVENING SESSION.

8 o'clock. Business Session. Reports of officers and committees.—Election of officers.—Amendments to the constitution.—General business.

FRIDAY, April 26, 1895.

MORNING SESSION.

9:30 o'clock. Meeting under the direction of the Committee on Theory and Practice of Gymnastics: Dr. Mary T. Bissell, Mr. Jacob Bolin, Mr. Herman J. Boos.

1. What Nervous Tests Must We Add to Our Strength Tests to Complete the Picture of the Individual? G. W. Fitz, M. D.
2. Vertical Script and Proper Desks as Related to Education, Edward R. Shaw, Ph. D.
3. Military Drill in Public Schools, E. H. Bayer.
   Among those who will take part in the discussion are Professor Cattell, Dr. J. S. White, Dr. Leipziger, Dr. D. A. Sargent, and Dr. Hitchcock, Jr.*
4. Additional topics are suggested, as follows:
   (*a*) Gymnastic Games in Physical Education.
   (*b*) Best Exercises for Developing Strength, Quickness, Accuracy, Wind.
   (*c*) Fatigue.

Free discussion is invited.

AFTERNOON SESSION.

2:30 o'clock. Meeting open to the public.

1. Practical Physical Training in Public Schools, Nettie D. Kimberlin.
2. The Influence of Physical Training on School Life, Supt. E. P. Seaver.
3. The Physical Element in Education, Prof. E. L. Richards.
4. The Use of Anthropometrical Methods in Public Schools, Wm. Townsend Porter, M. D.
5. Some of the Principles that Guide Me in Teaching German Gymnastics, E. H. Arnold, M. D.

EVENING SESSION.

7:45 o'clock. Exhibition of General Gymnastics in the Armory of the Twenty-Second Regiment, Boulevard and Sixty-seventh street, by courtesy of officers of N. Y. S. N. G.

* Messrs. White, Leipziger, and Hitchcock were absent.

SATURDAY, April 27, 1895.

MORNING SESSION.

9:30 o'clock.

1. Practical Methods of Teaching Physical Exercises to Public School Children, J. Gardner Smith, M. D.
2. The Relation of the Normal School to Physical Education, C. E. Ehinger, M. D.
3. The Gymnastic Era and the Athletic Era, E. Hitchcock, M. D.
4. Some Results of Physical Training in Secondary Schools, Jay W. Seaver, M. D.
5. Business meeting—open only to members of the Association. Unfinished business.—New business.

OFFICERS.

Jay W. Seaver, A. M., M. D., *Pres.*
C. E. Ehinger, M. D., *Treas.*
E. P. Lyon, *Sec.*
J. G. Smith, M. D., *1st Vice-Pres.*
Amy Morris Homans, *2d Vice-Pres.*
R. Tait McKenzie, M. D., *3d Vice-Pres.*

COUNCIL (WITH FOREGOING OFFICERS).

Edward Hitchcock, A. M., M. D.,
Elisha M. Mosher, M. D.,
H. E. Arnold, M. D.,
E. M. Hartwell, M. D., Ph. D.,
D. A. Sargent, A. M., M. D.

LOCAL EXECUTIVE COMMITTEE.

Dr. Watson L. Savage,
Dr. J. Gardner Smith,
Dr. Mary T. Bissell,
Margaret Stanton Lawrence,
Henry Metzner,
Jacob Bolin.

PAPERS PRESENTED BEFORE THE SECTION ON ANTHROPOMETRY AND VITAL STATISTICS.

[Miss Berenson in the chair.]

THURSDAY MORNING, April 25.

ANTHROPOMETRY INDIVIDUALIZED.

BY D. F. LINCOLN, M. D., OF BROOKLYN.

I.

The existence of a normal, ideal, or typical being, a standard of what the perfect man should be, lay at the basis of the science of anthropometry, as conceived by its founders.

A similar belief in an ideal is prominent in the history of sculpture. The Egyptians possessed a canon for the proportions of the erect human figure more than three thousand years ago; the Greeks borrowed from them; and since classic times man's imagination has run riot over the idea of an absolute standard of proportion based on geometrical considerations. We are informed by Fletcher that as many as one hundred and fifteen of these standards have been constructed, each claiming to present the typical man.

The sculptor's ideal is not that of the scientific observer. The artistic type refuses scientific control. The type deduced from statistics rests on its own feet—truth rather than beauty is its reason for being.

Instinctively, however, art and science are at one in *avoiding too wide a generalization*. Our sculpture idealizes the white race alone; it even throws out whole families of the white race in its desire for unity of type. Similarly, in anthropometry, it is evident that no profit can come from attempts at uniting whites with yellow, brown, red, and black races in establishing a "mean man."

Analysis of the nations of Europe shows the necessity of keeping in mind the subdivisions of great races. The blonde, tow-headed

German of the north cannot be confounded by the most careless observer with the dark, short, south German. It is needless to dwell on well-known racial varieties, or rather, great race distinctions, both in France and Britain. They have not vanished; fusion is not yet complete. Isolated communities still exist, presenting precious opportunities of identifying and describing the primitive stocks which mingle in the "Englishman;" a true national pride may do well to seek out these, ere modern currents sweep them out of their nooks into the general whirlpool.

We may safely leave the identification of sub-types among barbarous races to the modern investigator. But how is it with the great civilized races? The suggestion is offered that the ingredients of which these races are compounded have yet to be clearly noted by the methods of anthropometry.

Subdivision, then, is to be the key to future progress in this study: the race within the nation, the sub-type within the type. And may we not add, as belonging in the same line of study, the individual within the type? Or even, the individual as representative of type? A moderate number of well-selected persons of pure stock, well observed, will yield results infinitely more valuable than those drawn from large numbers taken without this discrimination.

Small groups, moreover, not only give us hints as to ancient types—they may point out the direction which nature is now taking to form new types. The measurements of soldiers in the War of the Rebellion indicate, with probability, such a tendency in Americans, viz., to an increase of stature in certain parts of the country. As a strongly marked instance of the tendency, I may say that the mountaineer of Eastern Tennessee deserves to be studied quite by himself; the data of a few observations among this race would furnish evidence of a higher value (because less generalized and diluted) than the data of the whole state.

In what has been thus far said it has by no means been the intention to deny the value of wide generalization. *Homo sapiens* is a useful conception for the zoölogist. "The White Race" is worth considering as a provisional unity. But these broader views blot out from sight the essential facts which narrower views reveal. The expression "Englishman" hides (instead of denoting) the ideas of "Cornishman," "Dane," "Frisian," etc. The broad type, in fact, is a mestizo-type, if type it be at all, and not a mere half-cooked

mixture. The broad type can be studied at any time, the sub-type is yearly growing less easy of study.

The intermixture of distinct types is the basis of the irregularity of the resulting curve, which may give the grotesque effect of two, or even more, means in one collection of data. Here is the key to the contest between means and averages, for in truly homogeneous data the average is absolutely the same as the mean.

II.

If the sub-type deserves special consideration as an approach to a fundamental fact, by much more does the individual.

As the sub-type disappears in the nation, so does the individual in the sub-type. In either case, the large result (embodied in averages and curves) is capable of destroying the essential features of the smaller group or the individual.

In seeking for data on which to construct a law of human growth, the earlier anthropometrists contented themselves with observations on very large numbers of people taken simultaneously, or, at least, without any attempt to repeat the observation on given individuals. These results were then sorted under "ages," and we were enabled to state the average or mean weight and height of a person at each age.

In a general way, these results have proved of great value. But it is beginning to be perceived that they must be supplemented by continued observations on known individuals. It is perceived, for instance, that if a large number of boys at the age of ten are massed, we may indeed get the law which represents the preponderant fact—under which perhaps 80 or 90 per cent. of the boys belong—in the form of the average. But we cannot be sure that the rest of the boys properly belong with the majority. The average does not justly represent the individual, any more than the army ration corresponds to the appetite of each soldier.

The insufficience of the common method appears in a number of ways, as follows:

1. In composite races like the English, there are many individuals whose measurements present not simply proportionate increase or diminution, not the normal type with a coefficient representing bigness or smallness, but who are probably sporadic representatives of distinct race-types. Who does not know whole families with

strongly similar traits, contrasting with other whole families? The one, ranging near six feet in height, the other, near five feet, four inches; contrasting in complexion, color of hair and eyes, precocity, longevity, capacity, character, and the nature of the diseases they are liable to. Such groups of relatives deserve to be studied collectively, apart from the rest, for the same reason for which we prefer them for composite photographs. They deserve tabulation apart from the general population. A composite could be made of their curves of growth separately for the sexes.

The existence of such families and of individuals, representants of race-types, unfused in the midst of a more or less fused population, is to be ascertained by submitting them to measurements. The results will of course be rendered much more valuable if the individuals are measured yearly, or oftener, from birth up to maturity, in order to get their curves of development.

2. A race-type, like a species, can be regarded from two points of view—the ideal, and the individual. The former harmonizes best with the pre-Darwinian ideas of species; the latter is thrust upon us by the new views of the origin of species, and the continuity of one species with its next neighbor. In any given species of shell we recognize a median, or type form, and extremes. It is to the latter that we look for hints of the tendency towards new development. So in the case of a human being, exceptional individuals may be taken as typifying a possible tendency to the formation of a new type. If we may employ the terms of political life, we may say that the exceptional forms and phenomena are entitled to a minority representation. There is a broad distinction between such cases and those which are properly classed as accidental, or the result of disease.

3. Curves of growth in height, weight, and other dimensions and capacities have been established upon the generalizing plan. So far as that plan is capable of being worked, these curves are correct. There is, however, the strongest reason for believing that individual curves may normally differ to a wide extent from the general formula. The fact can only be ascertained by numerous individual measurements from birth to maturity.

Let us illustrate by referring to the well-known retardation of growth before puberty. If some boys stop growing during their eleventh year, and others during their twelfth, and if their data are

compounded (as is regularly done), the result appears to show that boys' growth is checked during both these years. The general curve throws out individual facts in this way. And why may there not be some whose curve is depressed (by arrest of growth) at nine or ten years quite normally? We do not know how to answer this until we obtain individual records covering the whole period, year by year.

4. By an application of Galton's percentile gradè method, Professor Bowditch has re-distributed his original data derived from Boston school children so as to show the different heights by groups, likewise the different weights. He thus obtains, in place of a single curve of growth, eleven curves, representing as many sizes of children. These curves indicate a remarkable fact (if fact it be), to wit, that the period of rapid growth in children begins earlier in the large than the small. A boy destined to be a big man would, accordingly, begin to grow fast at twelve; one destined to be short would not grow fast until fifteen.

One thing is wanting (as Bowditch himself points out) to the completeness of this demonstration. We have no proof that the individuals who compose the groups in the tables are the same year by year. It is conceivable that some tall boys of sixteen who are growing fast this year were growing slowly last year, and *vice versa*. These results balance in the composition of statistics and disappear from sight. The question whether a boy may be beneath the average at one age and above at another, or whether a little baby may make a big man, is not answered by the "generalized" method.*

It is worth noticing that the Jews are stated to possess a growth curve which contradicts the law of early growth in large children. The Jews in the Gymnasium of Moscow (Sack), a much shorter and smaller race than the "Anglo-Saxon," have their most rapid growth from the twelfth to the fourteenth year, after which the rate falls off rapidly. In the Boston boys (of English or Irish descent) the ages (at last birthday) of most rapid growth were 14, 15, 16, for the 50 per cent. grade. Roberts puts it for the English artisan class at 13, 14, 15, 16. Thus the antithesis between races brings out

*Since reading the paper, the writer has learned from Dr. Beyer, of the Annapolis Naval Academy, that the individual records there kept prove that individuals frequently do pass from one percentile grade to another.

opposed principles. Within the limits of each race, it may still prove true that Bowditch's rule holds good for the race.

5. In the same line of argument stands the probability that the high school pupil represents a different class of the population from the primary scholar. He is selected by intelligence, capacity, family antecedents. His average does not belong with the average of the mass of the population. Hence we cannot admit that the school averages are valid as representing the rate of growth, after the age at which such discriminating tests are applied; say, after twelve years.

6. A similar discriminative selection is made by nature upon old men. It is possible that a larger proportion of tall men than of short men die after middle age. If this be true, it helps to account for the apparent diminution in height in the aged. Individual measurements, year by year, are required to settle the point.

7. Permit me now to call your attention to a possible extension of this subject in the connection between general development and sexual development. In doing this I am forced to take the position of an inquirer, for the facts are doubtful to me.

In the works of our best authorities we find such expressions as the following:

"About two years before the age of puberty, there is a period during which the growth in both height and weight shows a distinct acceleration." *

Another † states that the height, lung capacity, and weight of girls are nearly of full dimensions at the ages of 14, 15, and 16 respectively, "*i. e.*, at the age of first menstruation."

A third writer, ‡ speaking of boys, states that puberty coincides exactly, in the majority, with the maximum rate of growth, which is at the age of 15 to 16.

These three statements are not contradictory, but confirmatory. The rapid growth begins two years before sexual maturity, the maximum rate of growth coincides with it; and the rate of growth is much diminished after its occurrence.

The difficulty lies not in understanding the author's "meaning," but in fixing the date. Instead of occurring at "14 years, 7

* XXII Mass. Rep., 502.
† Shepard.
‡ Carlier.

months," the date of first menstruation is exceedingly movable. In Pagliani's tables it runs from the thirteenth to the eighteenth year, covering six years, without very great variation.

In the fourteenth year, less than one fifth of the cases are set down. The percentages run as follows, beginning at the thirteenth year—12¼, 19⅘, 17½, 16$\frac{9}{10}$, 10$\frac{9}{10}$, 9⅘,—comprising $\frac{11}{11}$ of all the cases.

An epoch which lasts five or six years is a hard one to date from. The question to be settled is one of causal relation. Is there any fixed relation between puberty and the acceleration of growth? Or is the relation a widely varying one, so that some girls accomplish nearly all of this great growth (which may average nearly eight inches) after the incidence of puberty, while others accomplish it before? Is there any law about it?

The importance of correctly understanding the laws of development in this point is very great, from a medical, a scientific, and an educational point of view.

Something is known as regards the influence of race, or rather of type. Light-haired girls reach sexual maturity, in Denmark, two years earlier than the dark-haired; and the same fact appears in Pagliani's observations in the neighborhood of Turin, where a large intermixture of races has occurred. If the light-haired races here concerned are the taller, it is interesting to know that they are in this respect precocious; for this would bring them into correspondence with Bowditch's law of early growth in large children.

In closing, a few practical considerations deserve mention. The object in view is to obtain continuous records of as large a number of individuals as possible, from birth to maturity (at least till 18 for women and 20 for men).

The records should be made at least once a year; better, once a month for the first three years of life. If once a year, a period of rapid change (accelerated growth in height, less in weight), like the spring, should be avoided; the neighborhood of the new year may be suggested as more desirable.

Continuity is best attained by making the practice a family institution. In asylums and schools there are breaks in time and individuality; no child is kept from birth to maturity under one care, unless it be that of his own family.

The interest is enhanced, in the case of children, by noting the

development of the faculties of speech, movement, perception, thought. Such data belong with the study in question, as do facts relating to illness, diet, residence, school.

It is possible to add special interest by weekly or daily weighings, noting for comparison the dates of appearance of sicknesses.

A DIAGRAM OF WORKING CAPACITY AND RESISTANCE AS MANIFEST IN GYMNASIUM EXERCISES.

BY DR. CLÄES J. ENEBUSKE, BOSTON.

At the seventh annual meeting of the American Association for the Advancement of Physical Education, I called attention to the relation, apparently existing, between the gymnastic working capacity of an individual and certain measurements of the same individual, such as are ordinarily recorded in our gymnasia.

I presented the subject in a paper entitled "Some Measurable Results of Swedish Pedagogical Gymnastics," which afterwards was printed in the Proceedings of the meeting of the A. A. A. P. E., 1892.

In the following year, at the session of the International Statistical Institute in Chicago, September, 1893, I presented some results of continued study upon the same subject in a paper, entitled: "An Anthropometrical Study of the Effects of Gymnastic Training on American Women." This paper was subsequently printed in the quarterly publications of the American Statistical Association, December, 1893.

In these papers were considered chiefly the following items: height, weight, lung capacity, total strength, the latter term taken in its conventional meaning, namely, the sum of the strength measure of the legs, back, chest, left and right forearm. Most of the discussion was devoted to the ratio of these items, expressed in the following indices:

1. *Weight-height index*, i. e., ratio of weight expressed in kilo and height expressed in centimeters ($= \frac{W}{H}$).

2. *Vital index*, i. e., ratio of vital capacity expressed in liter, and weight expressed in kilo ($= \frac{L\,C}{W}$).

3. *Strength-weight index*, i. e., ratio of total strength, expressed in kilo and weight in the same unit ($= \frac{TS}{W}$).

4. *Vital strength-weight index*, i. e., the product obtained by multiplying vital index by strength-weight index ($\frac{LC \times TS}{W^2}$).

5. *Power index*, i. e., the product obtained by multiplying vital index by total strength ($\frac{LC \times TS}{W}$).

In the report of the chief of the Bureau of Medicine and Surgery to the secretary of the navy, 1893, is an article by Henry G. Beyer, M. D., Surgeon, U. S. N., entitled, "Observations on Normal Growth and Development of the Human Body under Systematic Exercise." In this paper are presented the results of physical training of fifty naval cadets, as recorded by measurements.

Besides observations on height, weight, lung capacity, total strength, and certain other items, there are also given comparative tables of vital index, power index, strength-weight index, and vital strength-weight index.

Before the appearance of any of these three papers, Mr. Demény, the French physiologist, had presented some observations upon the ratio of lung-capacity and weight in its relation to physical training. Demény's observations are published in *Comptes rendus des Séances de la Société de Biologie*, Paris, 1889, and are quoted in the first-mentioned of my papers.

These four papers contain, so far as I am informed, everything that has been published hitherto upon this subject. I refer those interested to these papers for a fuller discussion of the results so far of the study of these indices.

To-day I wish only to recall so much of these results as is necessary for the presentation of my present subject,—a diagram of working capacity and resistance as manifest in gymnasium work.

This diagram was constructed by me two years ago as a result of my observations up to that time upon the parallelism apparently existing between the gymnastic working capacity, and resistance against fatigue, on the one hand, and on the other the value of the indices, which I have just mentioned, computed from the measurements of height, weight, lung-capacity, and total strength.

The diagram is built up of five lines radiating from the same starting point below with equal degree of inclination towards each other. This starting point is marked zero (0). From the 0 point the five radiating lines are divided by concentric circular segments at equal

distances from each other, thus dividing the diagram into a number of concentric zones. These are marked by figures on the central perpendicular line, beginning with one and continuing upward to ten or more, the intervals being subdivided by tenths. This central line is the line of strength-weight index, which in the cases hitherto observed by me varies between two and ten.

To the left of this line is the line of vital index; an index which in the cases examined by me hitherto varies between 0.0300 and 0.0800.

To the right of the central line is the line of vital strength-weight index, which in my cases varies between about 0.0400 and 0.7800.

The line to the left of vital index is that of weight-height index, this index varying in my cases from about 0.270 to 0.500.

The line farthest to the right is the power index line. The variation of this index in the cases observed by me extends from about 4 to 54.

The relation of the figures upon the weight-height (Wh), vital (Vi), and power (Po) index lines to those upon the strength-weight (Swi) index line has been determined by experience. The figures upon the vital strength-weight (Vswi) index line are determined as products of Vi and Swi upon the same circular division line.

To the left of the diagram proper and separate from it is a scale of centimeters, upon which the height is recorded.

For a clearer understanding of the meaning of the diagrams, which I am about to demonstrate, permit me to quote a few summary lines from my previous publications upon this subject.

1. *The weight-height index* expresses how much weight an individual possesses for every centimeter of his stature; for instance, Wh = 0.340, i. e., 0.340 kilos for each centimeter of stature.

2. *The vital strength-weight index* grows parallel with the growth of efficiency and adaptability to gymnastic exercises, and is indicative of the degree of an individual's training with reference to gymnastic exercises. This index becomes still more instructive in this respect if its component vital index and strength-weight index are consulted also.

3. Under ordinary circumstances those women of *vital strength-weight index* lower than 0.2000 are not in condition for gymnastic exercises so vigorous as climbing; those of 0.3000 or more are in

excellent condition for such exercises; those between 0.2000 and 0.3000 are between unable and well-conditioned, or in general:—

Imperfect climbing under difficulty corresponds to index,	0.2000—0.2500
Growing ability to climb,	0.2500—0.3000
Ease in climbing,	0.3000—0.3500
Great ease in climbing,	0.3500—

4. Under ordinary circumstances the *vital index* necessary for ability to climb is in the neighborhood of 0.0474, but in combination with a high strength-weight index or a very energetic moral disposition, some imperfect climbing may exist with even lower vital index, and has been observed in a case with as low a vital index as 0.0444.

5. Under ordinary circumstances the strength-weight index necessary for ability to climb is about 5.4; but in combination with high vital index or a very energetic disposition, climbing may be possible with lower strength-weight index, and some imperfect climbing has been observed in a case with strength-weight index only 3.6.

6. Two vital strength-weight indices of equal number may have different values as exponents of physical efficiency, depending upon whether they are composed of a vital index and a strength-weight index of corresponding heights or of a high and a low index.

7. So far as can be judged from observations hitherto made, the vital strength-weight indices of women which correspond to the highest efficiency of the most manifold adaptability in the gymnasium are those composed of a strength-weight index of 6.2 or more, and a vital index of 0.0550 to 0.0600, or somewhat above 0.0600. Those composed of a low strength-weight index and a vital index considerably higher than 0.0600 (0.0650 or more) are more difficult to estimate, and their number is comparatively small.

8. While the vital strength-weight index grows parallel with aptitude in such exercises as demand the weight of the body to be lifted by the individual's own muscles (as climbing, jumping, etc.) the power index shows a more marked correspondence with the growing capacity in such exercises in which outer resistance is combated. It deserves to be noted that the power index, being the product of vital index and total strength, i. e., $(\frac{L C \times T S}{W})$, is also the product of vital strength-weight index and weight, i. e., $\frac{L C \times T S}{W 2} \times W = \frac{L C \times T S}{W}$.

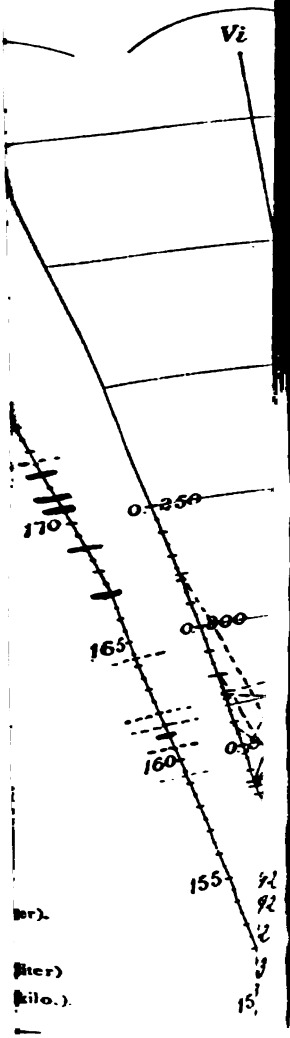

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DIAGRAM I.

This shows the development of the average curve of a junior class of twenty-six female students of the Boston Normal School of Gymnastics. Average age is twenty-two years. The development for each month during the period, October 1, 1892, to May 1, 1893, is indicated by the successive curves, each marked by letters *a*, *h*.

DIAGRAM II.

DIAGRAM III.

This shows the curves of working capacity of six female students, graduated by the B. N. S. G. in 1893, out of about one hundred students, graduated by the school up to that time. These six have reached the highest mark in practical gymnastic accomplishment. In marking for gymnastic accomplishment the standard in the following aspects has been considered:

1. Strength.
2. Endurance.
3. Purity and beauty of postures.
4. Precision of movement.
5. Ease of motion, or grace.

It should be observed that all six have reached a Vswi of 0.3000 or thereabove. The student N° 76 (curve *a*) shows the peculiarity, that while Vswi (0.3100) is of the same height as the corresponding index of the student N° 56 (curve *b*), this index of the former is composed of a low Vi (0.0410) and a high Swi (7.6), while the latter has her Vswi composed of Vi and Swi of corresponding heights or 0.0565 and 5.6 respectively.

DIAGRAM IV.

DIAGRAM V.

DIAGRAM VI.

In this diagram is presented an approximative comparison between the gymnastic working capacity of the average of forty-two female graduates of the B. N. S. G., class of '93, and that of certain selected classes and individuals. The curve *l* represents the working capacity of a male student of the B. N. S. G., class of '95. This is the highest curve that has come under my observation hitherto. The curve *k* represents similarly a male student of the B. N. S. G., class '95.

The curve *j* represents similarly the Yale student of the 50 per cent. grade (male).* This curve represents also the average of fifty naval cadets, U. S. N.†

The curve *i* represents a male student of the B. N. S. G., class '93.

The curve *h* represents the average Amherst student (male).‡

The curve *g* represents the female student N° 161 of the B. N. S. G., class '96,—out of all female students measured in the B. N. S. G. hitherto, this has reached the highest curve.

The curve *f* represents the female student N° 56 of the B. N. S. G., class '93. She is the student of the school whose working capacity curve nearest corresponds to the average curve of the female graduates.

The curve *e* is the curve of average of forty-two female graduates of the B. N. S. G., class '93; average age, twenty-three years.

The curve *d* is the average of the new, entering students of the B. N. S. G. in the autumn, 1892, before their gymnastic training had been begun.

The curve *c* represents the average working capacity of 1,100 female students of Wellesley College.§

The curve *b* represents the female student N° 101 of the B. N. S. G. She is the weakest student that has been admitted to the normal class of the school.

The curve *a* represents a young woman who was found too weak to be admitted to class-work in the school.

It is evident, without explanation, that the diagram which I have demonstrated does not express anything with scientific exactness, in the emphatic meaning of the word. The instruments of precision, so called, with which we measure, are not instruments of precision at all. Still they are sufficiently precise to be accepted by us all and to be of general use for our practical purposes.

The diagram has grown forth in the gymnasium by observation of actual cases under gymnastic training, and is presented here for the service it can give in practical gymnasium work.

Within the limitations explained in this and my former papers upon this subject, the diagram expresses as well as can be done

*Seaver, Anthropometry.

†Beyer, l. c.

‡Hitchcock, "Anthropometric Study of the Students of Amherst College," 1892.

§L. E. Hill and M. A. Wood, "The Average Anthropometric Table, Wellesley College Gymnasium."

with our present methods of measurements a numerical and graphical parallelism with the gymnastic working capacity such as it actually manifests itself.

It offers a means for approximate comparison between different degrees of training of the same individual or class, and for such comparison between different individuals and classes.

It should be remembered that what has been stated in regard to this diagram and the indices by which it is composed refers to healthy individuals only.

It has been tested by me in about two hundred and twenty cases, and has been of great service in my practical work in gymnastic training, also for this reason, that it has facilitated the recognition of single less normal cases in the classes, which otherwise might have passed unnoticed.

DISCUSSION.

Dr. Hartwell.—I should like to ask Dr. Enebuske if this system of indices has been used by Demeny, or any one else, for determining the effects of systematic exercise on boys and girls at earlier ages, before they have attained their full growth in muscle and in bone, or before their post-pubertal retardation of height comes on?

Dr. Enebuske.—There is in the paper of M. Demeny which I refer to, a statement regarding observations of his on children at a college. He does not state the ages of the children and does not state the number of children, and, if my memory does not deceive me, it is only of boys he speaks. But he says that the observations he has made at this college have led him to consider that the growth of weight and the growth of lung capacity in that age is parallel, about; of course not exactly parallel, but about.

Dr. Hartwell.—I hope this method will be taken up and availed of in the secondary schools and in the colleges as well, because Dr. Enebuske's paper seems to show that latent powers and capacities may be brought out by special training, *after* growth has been determined. The question suggests itself, Can we by special training prolong the period of growth and secure not only a better trained body, but also a larger and stronger one?

Dr. Enebuske.—My observations hitherto have led me to believe that there exist a number of limitations to the development of the

individual and that it is entirely impossible, by any method of training, to bring a given individual up to the same height in any one of these indices as another individual may present. Every one has limitations of his own. There are a number who come in with a very low vital index—at about 400, or between 300 and 400—and during the first three months of training this index goes up to this height (indicating) 500 very rapidly, without great effort; while there is another class who only go up step by step, and come up to about this height after two years' training. It occurs to me that so far as young women are concerned, without excessive weight-height index —I mean between 270 and 400, about—most of them will by training keep up in the region of the fifth zone. There is still another type, which is represented by about ten out of one hundred in those cases I have hitherto observed, who come in with a very high vital index, and those generally have a very low weight-height index, and with this combination they have a very low strength-weight index, and are not good for gymnasium work at all.

Dr. Beyer.—Dr. Enebuske's first paper I consider a very strong attempt at determining more precise connection between substance and its function, which is what we must all come to. If the result of physical training amounts to anything at all, I think it ought to show itself in increased function of the substances of which we are made up; and here, as those of us who have taken any measurements are aware, we lack definite tests. For the last three years I have followed out Dr. Enebuske's suggestions, which I cordially accepted at Philadelphia. In everything which he has said to-day, so far as my observations go I can confirm them. I have only about sixty or seventy individuals a year upon whom to make such observations, but so far as vital-strength-weight index as a test of climbing is concerned, it is true. I have not embodied my few observations in a paper to present to the Association, because I am waiting for a larger number, and that only time can furnish.

THE GROWTH OF BOYS.

BY SCHUYLER B. MOON, OF MC DONOGH, MARYLAND.

It will be necessary first to give a brief account of the material which forms the basis of the comparison to be made between the boy and the man, and to explain the method by which they are to be compared. During the past eight years each boy of the McDonogh School, situated near Baltimore, Md., has been measured once annually. From these measurements a percentile table for each year of age from eleven to fifteen has been compiled, the measurements of from one hundred to one hundred and fifty boys being employed in compiling each table. The fifty per cent. columns of these tables are taken to represent the typical boys of the years of age from eleven to fifteen respectively. The fifty per cent. column of Dr. Seaver's percentile table, compiled from the measurements of Yale University students, has been taken to represent the typical man. In order to compare the typical boys of the different ages with this typical man, their heights have been made equal to his, and their other dimensions increased in the same ratio. The resulting numbers, when plotted on Dr. Seaver's table, furnish a diagram by means of which we may quickly ascertain in what respects the boy is, relatively to height, inferior to the man, his equal, or his superior. To be more explicit, let me refer you to Chart I. The dotted line on this chart represents the typical boy of the age eleven. His height is 1349 millimetres, while that of the typical man is 1724 millimetres. Dividing 1724 by 1349 we obtain the factor 1.278, and multiplying each measurement of the typical boy by this factor, a set of numbers is obtained, which, when plotted upon Dr. Seaver's table, gives the dotted line as in Chart I. Weight must, of course, be multiplied by the cube of this factor. Since the results for the right side of the body are similar to those for the left, it is unnecessary to give both. For such cases the diagrams on these charts represent the mean between the right and the left, this being perhaps more nearly correct than either alone.

On account of the small number of boys measured, and other obvious sources of error, these results can hardly be relied upon for general conclusions. Yet the indications are in some cases so

strong, and the results for homologous parts of the body so uniformly harmonious, that some inferences, at least, may safely be drawn. It will be impossible to present a full discussion of this subject here to-day. Only the more important points will be brought to your notice, and these briefly.

Let us now examine Chart I, remembering that the dotted line represents the age eleven, the black line the age fifteen. A glance reveals the fact that at eleven as well as at fifteen the boy is, in the relative sizes of the parts of the body, quite different from the man, and hardly less so at fifteen than at eleven. These differences are particularly well marked in the measurements of the head, vital organs, and feet, since these parts, as is well known, outstrip the others in growth during childhood. Height of knee, sitting height, shoulder to elbow, and elbow to tip show that at fifteen a boy's limbs are relatively longer in proportion to his body than those of the man or the boy at eleven. In the muscle girths—waist, hips, thigh, calf, biceps, and forearm—the boy is, relatively to height, inferior to the man, while in bone girths—knee, ankle, instep, elbow, and wrist—he is superior. In muscle girths the boy at fifteen is, relatively to height, superior to the boy at eleven, and more nearly the equal of the man. In bone girths he has also grown relatively larger, except in the case of the instep, but this increase puts him still farther from those proportions which he will finally have as a man.

In order to study the growth of these parts more closely, let us examine Chart II. Here those measurements which are distinctly bone lengths, bone girths, and muscle girths have been selected, and the measurements of the typical boy of each year of age from eleven to fifteen have been plotted. To avoid the confusion of too many intersecting lines, numbers have been placed in their stead, the number 1 representing the age eleven, 2 representing twelve, and so on to fifteen.

Now it is plain that, if, for any two successive years of age, the numbers fall at the same point for any part of the body, that part has for the intervening year a rate of growth in proper proportion to the growth for the same year in total height. Also, an advance toward the right indicates a relatively accelerated growth in any part, and a retrogression toward the left shows a relatively retarded growth.

CHART I AGE 11 ····· AGE 15 —

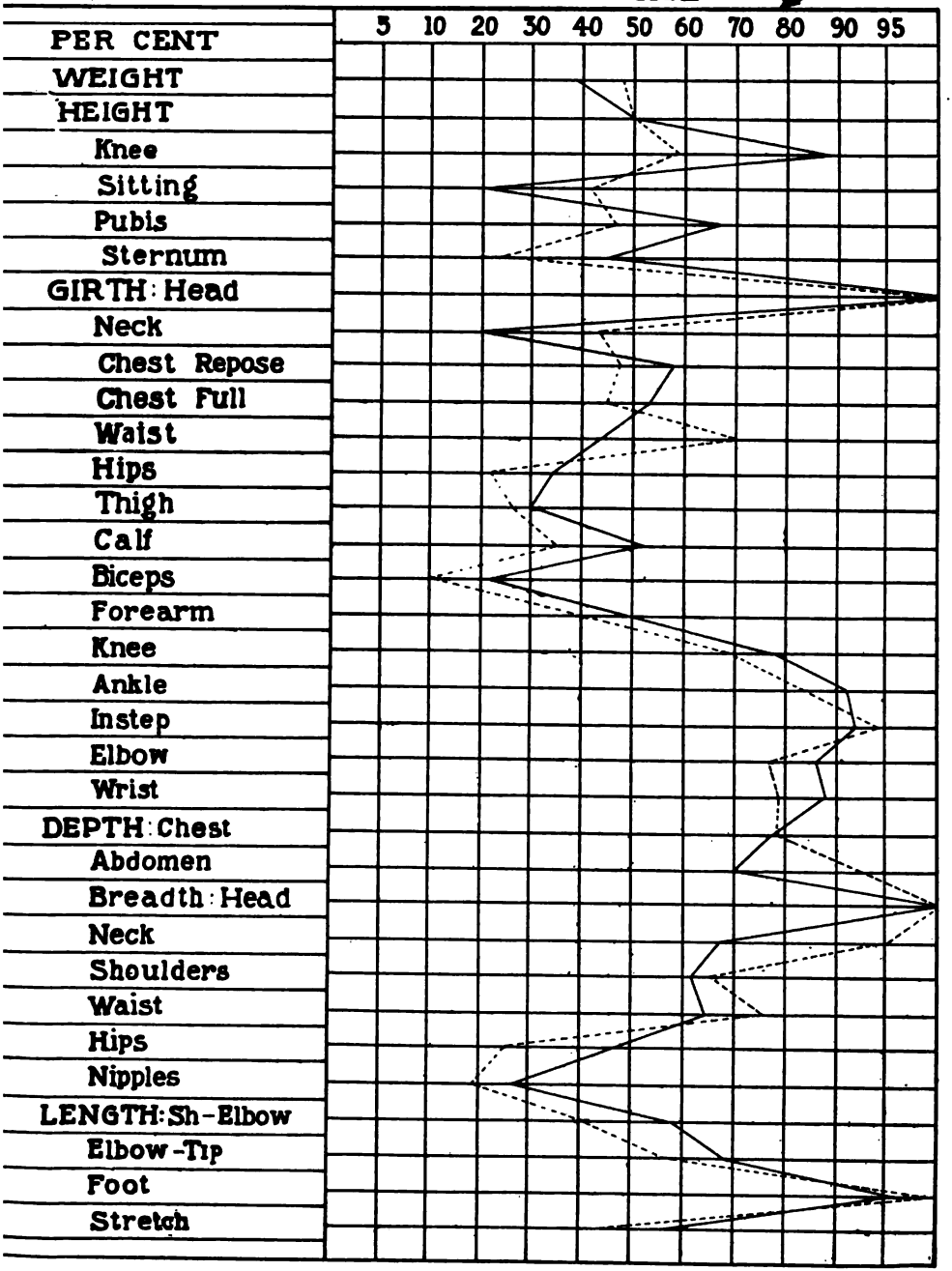
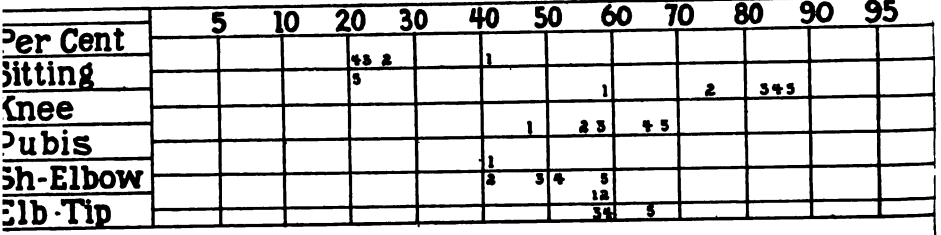
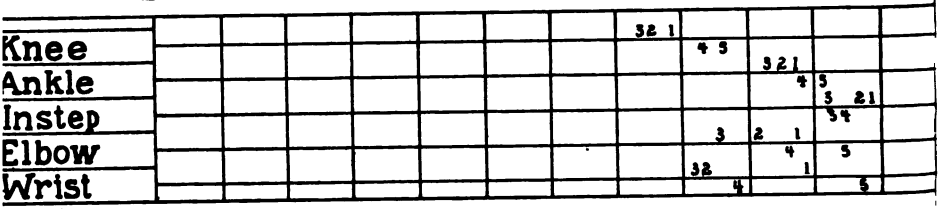


CHART II

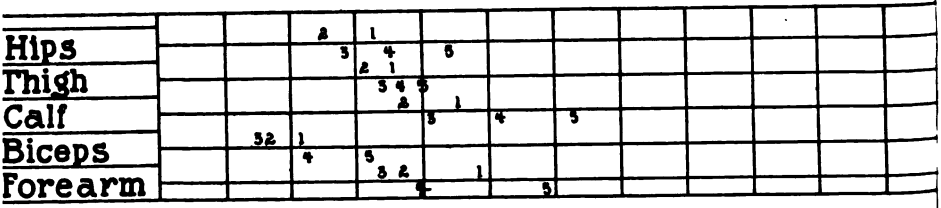
BONE LENGTHS



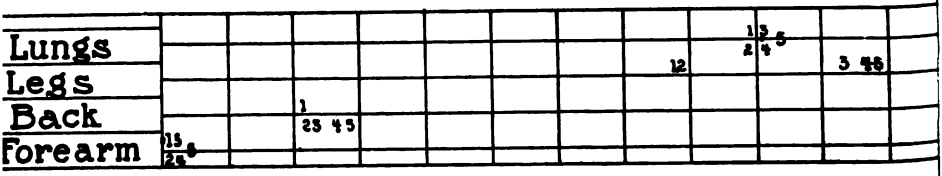
BONE GIRTHS



MUSCLE GIRTHS



STRENGTH TESTS



STRENGTH OF LEGS

Per Cent	5	50	95
Age 11	83	125	185
Age 15	133	213	314
Yale	136	186	247
Harvard	117	176	274
Amherst	112	169	238

Upon examining the bone lengths, we learn that in sitting height, that is, in the length of the vertebral column, there is a retarded state of growth relative to height during the entire period from eleven to fifteen. In height of knee, on the contrary, the growth is relatively accelerated throughout this period. There is a gradually quickened growth, relative to height, on the part of the vertebral column, while the accelerated growth in height of knee regularly diminishes. Remembering that height of pubis represents the sum of height of knee and length of the thigh bone, and comparing the intervals between the numbers in the case of height of knee with those for the pubis, it is found that the growth of the thigh bone in length is, relatively to height, greater in the latter part of the period than in the first part. In length from shoulder to elbow the rate of growth appears also to increase after the age of twelve, while in length from elbow to tip there is little variation till the age of fourteen, when the growth is relatively quickened.

In considering these results, due regard must be paid to certain facts concerning the growth of boys which Dr. Bowditch has demonstrated from measurements taken of Boston school children. Dr. Bowditch has shown that, at about the age of eleven or twelve, the growth in height is decidedly retarded, and that immediately afterward an acceleration in growth occurs, so that, at the age of thirteen, or thereabouts, a boy's height increases more per year than at any other year of age from five to seventeen. The period of retarded growth for McDonogh boys is from twelve to thirteen, and the period of accelerated growth the two succeeding years. Regarding total height as being made up of height of knee, length of the thigh bones, and height of the vertebral column, it is found by calculation from the tables that the retardation occurs in all three parts, while the acceleration takes place only in the vertebral column and thigh bones, height of knee actually increasing less per year at the age of thirteen and fourteen than at eleven.

An examination of the numbers in the chart of bone girths shows that in all cases there is a retrogression from the age of eleven to thirteen, and afterward an advance toward the right till the age of fifteen. This indicates that the retardation and acceleration of growth in total height are both even more marked in the bone girths. In the case of the instep, which is so much overgrown, the accelera-

tion dies away sooner as is evidenced by a retrogression after the age of fourteen.

The chart of muscle girths shows that the growth of the muscles is closely in accord with that of the bone girths. The period of acceleration, however, begins a year earlier in the muscles of the legs, that is, at twelve instead of thirteen.

In plotting the strength tests the square of the factor used in magnifying the linear dimensions of the boy has been used, since the power of a muscle is proportional to the area of its cross section. This, of course, is a mere approximation, but it may serve to show something of the development of muscular power in the boy. It appears from the chart of strength tests that strength is developed in the expiratory muscles and those of the legs earlier than in the muscles of the back and forearm. For strength of lungs the numbers fall at the same point for each of the five years of age. Strength of back shows an advance toward the mean, and strength of forearm shows a like advance, but even at fifteen it has not reached the two and a half per cent. column. In strength of legs a very marked increase occurs between the ages of twelve and thirteen. This is in entire accord with the growth of the muscles of the legs, for which we found, in the chart of muscle girths, the twelfth year to be the turning point. The increase, however, is proportionally so much larger than the corresponding increase in size of the muscles as to lead one to suspect that it is due rather to a rapid development of the nerve centres controlling these muscles than to any physical change in the muscles themselves.

This increase in strength of legs goes on at such a rate for McDonogh boys, that at fourteen years of age the boy actually appears to be stronger than the man, and at fifteen the boy's strength of legs is 213 kilograms, while the man's is only 186. The chart of strength of legs is intended to call special attention to this point, and, in order to obtain a wider range of comparison, the tests of Amherst and Harvard students are added. In view of the discrepancies between these tests and those of Yale students, as well as the inexplicable apparent result that a boy's legs are at fifteen stronger than a man's, may we not inquire into the value of our strength tests? What is the object desired in making a strength test? To ascertain the absolute power of the muscle or muscles undergoing

the test, when called into action, under proper conditions, by the strongest will power of which the person tested is capable. Even then, as Dr. Foster tells us, we probably do not get the maximum contractile power of the muscle, the will being unable to call forth its greatest contractions.

But how shall we know that the will power of the person tested is fully exerted, and that the power of the muscle is brought to bear upon the dynamometer so as to produce the maximum result? These questions are specially applicable to tests taken of young boys, in whom perfect control of the muscles by the will is by no means fully established, and whose awkwardness in handling the dynamometers is a serious obstacle to obtaining the results desired. To obviate these difficulties as far as possible, several boys of about equal strength have been tested together at McDonogh, in order that, by imitation, their strength might be brought to bear in the most advantageous manner upon the dynamometers, and that, by rivalry, they might receive the necessary nerve stimulus. In testing the strength of legs, their knuckles have been firmly secured, and discomfort avoided, by placing soft pads upon the thighs. The results you see before you. May we, in view of this, rely with certainty upon the accuracy of any strength test as at present conducted? I leave the question with you.

BOWDITCH'S LAW OF GROWTH AND WHAT IT TEACHES.

BY DR. EDWARD M. HARTWELL OF BOSTON.

I shall read my paper, in a way, by title, as what I particularly desire to bring to your attention relates to certain charts which I have here. I will present the tables which constitute the numerical basis for these charts, should the committee care to publish them.

Bowditch's law has already been alluded to more than once this morning. It is very interesting to note how many applications of it have been brought into view by closer study; and how much light it begins to throw upon various educational problems,—light which may be availed of not only in physical training, but which, as it

seems to me, bears also upon school hygiene and the construction and conduct of school curricula.

The following may serve as a condensed statement of this law: There is a pre-pubertal acceleration of growth in height and weight both in males and females, followed by a post-pubertal retardation in such growth; and girls, when growing most rapidly, exceed boys of like age, in height and weight. Perhaps the most important and interesting point brought out by Dr. Bowditch is this, that the law varies for the two sexes, so that in the female acceleration of growth in height and weight begins earlier than in the male, proceeds faster, culminates earlier, and sinks more rapidly,—this is quite in harmony with the general law of growth and development of the precocious sex. If we consider certain functional abilities of the girl, as for instance, her ability to learn to walk and talk, we find that she is more precocious than the boy.

Dr. Bowditch was the first to call attention to the facts of which I have spoken regarding growth rates, and to enunciate the law in its more general terms, on the basis of an examination of the difference in height and weight of some 25,000 Boston school children of various ages, twenty years ago. Prior to the publication of Dr. Bowditch's papers, Dr. Cowell, in England, had published a table, which showed certain of the facts to which Dr. Bowditch called attention, but Dr. Cowell's results appear to have attracted no particular attention. A few weeks since, in looking through a pamphlet entitled, "Das Kind and Der Schultisch," published in Zürich, in 1865, by Dr. Fahrner, who measured 1,789 children for the purpose of determining what kind of desks and seats they should have, I found that Fahrner had discovered and announced the law in respect to growth in height ten years before Bowditch's observations were made. That Fahrner's paper should have been unnoticed by anthropometrists for thirty years is singular, to say the least. But Dr. Fahrner's prior observations do not detract from the value of Dr. Bowditch's work, or invalidate the claim which may fairly be made that the law was first emphatically and clearly enunciated by an American scientist. The validity of this law has since been confirmed, practically speaking, by all observers that I know of in this country or in Europe. That is to say, the law is borne out by the observations made on American school children by Peckham in Milwaukee, Dr. Porter in St. Louis,

and Dr. West in Worcester, Mass. The results of the observations of C. Roberts in England, Key in Sweden, Hertel and others in Denmark, Erismann in Russia, Pagliani in Italy, and Geissler and Ulitzsch in Saxony are all of the same tenor, although the age of maximum growth in height and weight varies somewhat in different races and different countries.

I had occasion to determine the number of children in the Boston schools who were afflicted with the habit of stuttering, that being a neuro-muscular disorder due in part to the failure of teachers to recognize and apply the principles of physical training in teaching reading and the use of the vocal organs. My first census showed that there were about five hundred children who stammered or stuttered. I found, as is usual, that there were three times as many boys as girls who were subject to this form of nervous disturbance. Finding that the age when stuttering was most frequent was not the same for girls and boys, I endeavored to ascertain whether the percentage of the stutterers could be correlated with their growth-rates. Having occasion to study death-rates, I was struck with the fact that, taking a large number of mortality tables at random, the lowest death-rate fell in the period between ten to fifteen, for the two sexes, or for each sex separately. I began to wonder what the death-rates would be at individual years of life for the two sexes; whether they would in any wise correspond to the law of growth in respect to height and weight.

I was unable to find either persons or papers that answered my questions on this point. The nearest answer I could find was in a statement by the English statistician, Dr. W. Farr, which is to the effect that death-rates decrease until the age of puberty and increase thereafter. I found most mortality tables were computed for decades or half decades, and that tables showing the death-rates of American children at individual years of life for each sex were not to be had. Consequently I went to work and computed the Boston death-rates at individual ages (0 to 21 years) by sex for three different years, viz., 1875, 1885, and 1890, and combined them under the head of "specific intensity of life." As shown in the chart, specific intensity of life is the mortality rate upside down so to speak; it reaches its maximum when the death-rate is lowest. Then I found what is shown on the chart, that in Boston girls specific intensity of

life culminates a year or so earlier than is the case with Boston boys.

You will observe that the year of minimum death-rate, which is the year in which this specific intensity of life is highest for Boston girls, is 11 to 12; and that the year in which Boston boys show the greatest resistance to lethal influences is 12 to 13. Under the curves for specific intensity of life are curves showing the rates of growth in height and weight of Boston boys and girls, based on Bowditch's tables. Please note, however, that these curves showing growth-rates, are drawn to show the "relative increase of the average" (after Minot's method) instead of to show the average annual increment in pounds and inches, which is the more usual, though less accurate, way of constructing such curves; the curves showing rate of growth in height and weight, and the curve showing specific intensity of life reach their maximum height in the same year, viz., 11 to 12 for girls. The correspondence in the boys' curves is not so close, since their growth-rates culminate from one to two years later than 12 to 13, when their specific intensity of life is highest.

The character of the curves is interesting, too. In general the curves for girls are the more regular and even. The period of accelerated growth and of relatively high specific intensity of life is more prolonged in the case of males than females; there is more of the mountain-peak contour in the curves of the latter, and more of the table-land contour in the curves of the former.

Corresponding with these changes, with the great ups and downs in specific intensity of life, and of growth in respect to height and weight, are periods of special susceptibility to nervous disturbances which declare themselves through motor disorder in the breathing organs, the vocal organs, or the articulatory organs in the form of disease which we term stammering or stuttering. The periods in which the greatest amount of stuttering occurs are not coincident for the two sexes, —the facts are indicated by the "stuttering curves" at the bottom of the chart. There is almost three times as much stuttering among boys as girls; and there are other facts derived from the study of nervous diseases which suggest the importance of determining how far and at what ages boys and girls are respectively most susceptible to insanity, chorea, headache, anaemia, etc. The solution of this class of problems would not be an easy one, though it is greatly to be desired.

Even amongst unborn children the chances and changes of mortality are more favorable for females than for males. It appears to be more difficult for Nature to turn out male than female organisms. More male infants are born dead, more die within twenty-four hours after birth, and more within the first year and the next five years. The first year of life is a year of severe tests. Specific intensity of life is at its lowest, and about ten per cent. of the children born alive fail to enter their second year. Possibly it is not until the second or third year that you can really determine what the true rate of growth in normal infants is. At present, we must admit that the relation between growth- and death-rates before and during adolescence does not exist in infancy, since both growth- and death-rates appear to be maximal during the first year of life. The probability which exists in the first twelve months of life, that the organism will die within a twelve-month, is greater than it is again until about the eightieth year.

If we accept the suggestion of the German physiologist, Burdach, that the changes concomitant with the establishment of puberty are tantamount to a new birth, we may say that the organism undergoes three births during the period of immaturity. At birth the question is, Can the infant functionate as an air-breathing animal? Not a few infants die without drawing a full breath, and not far from one tenth of the deaths which take place within twelve months from birth occur within the first twenty-four hours after birth, because the bodily machine, through structural defects or lack of motive power, is unequal to making even a trial trip. The conditions of growth and development are such that the brain and nervous system lead up to the seventh or eighth year, when comes the second birth, marked by the appearance of the permanent teeth and the culmination in the growth of brain tissue as regards weight. Then you have your third birth when adolescence is established. This is attended by rapid growth of the skeleton and the skeletal muscles, and rapid development of neuro-muscular and mental power in many directions. The last of the three periods into which immaturity is thus divided seems to be the most fateful and influential in determining the constitution and character of the adult. Complete control and use of their organs of sense and motion cannot be attained by most of our children while they are in school. The period of "*culture*," physical or other, does

not lie in the grammar-school period. In view of these facts, we had better not aim at "physical culture" for school children. It is physical *training* that they need. They are not ripe for true "culture" of any kind. We should, it seems to me, recognize the fact, that during most of school life the girl is from one to two years ahead of the boy, mentally and physically, and should apportion her burdens and test her strength and ability accordingly. If we continue in our present way of doing things, some day we may have to go in for separate schools in order to protect the boys from over-study and over-work!

With regard to the disease of stuttering, I found but little of it in the kindergarten, in which very little is attempted in the line of formal language training. But in the third and second classes of the primary grade, in which reading is a leading subject, the curves for stuttering frequently reached their maximum. This suggests an inverted or unnatural method of training the organs concerned in the complicated process of vocal utterance. Again the boys suffer more than their more precocious sisters. In writing, drawing, and manual training, as well as in vocal training, the motor element is so prominent and important that we may fairly insist on the desirability, or rather the necessity, that teachers in these subjects should understand the laws of physical training, on the intelligent application of which the success of their instruction is so largely dependent.

Here are some charts, to which I will only call attention. They show the percentage relation of sitting-height, knee-height, and the lengths of thigh, shoulder, elbow, and elbow-tip to total height in each sex; they are derived from Dr. Sargent's graphical charts. It appears that the female is relatively longer in the body than the male, —that is to say, she has shorter legs, and she has shorter thighs; furthermore, she is shorter in the arms, shorter in the upper segment, and in the lower segment, too. These facts have an important bearing, I think, as to the seating of children in school. Girls need lower chairs than do boys of the same height. They can sit comfortably at higher desks also; but if their chairs are placed at a plus distance, or at too slight a minus distance, or at a *nil* distance, girls are less advantageously placed than boys of the same height for using the top of the desk in writing or drawing. There is greater need for the girl to seek the support of the desk in writing or to prevent

herself from falling into the collapsed position with rounded or twisted back, which results from fatigue. To reach the desk she must lean farther forward, she must make more of a bow of her spinal column, and depart further from the position in which there is least expenditure of nervous energy required for sitting still and erect. If she twists herself into one of the wretched positions so common in writing, the force of gravity gets a still stronger grip and pull upon her. Having a less bulky and massive skeleton, and being more given to sedentary pursuits, the distorted school girl is likelier to develop scoliosis than the distorted school boy. We know there is much more scoliosis among girls than boys, and that it is denominated a "school disease." I submit that it is probable, to say the least, that one reason for the larger number of female than male scoliotics is to be found in our failure to take secondary sexual differences in respect to length of limbs into account in our systems of school seating.

These are some of the interesting points which seem to me to be suggested by a study of Bowditch's law with regard to the growth and development of the two sexes. I believe that not only anthropometrists, but teachers, should seek to understand and apply it.

I would also call attention to the fact that Boston boys and girls had a lower specific intensity of life than Norwegian or Swedish boys and girls during the same period. After I had worked out the death-rates of Bostonians, at individual ages, by sex, 0 to 21 years, with many weeks of labor, I chanced to find a mortality table, published in 1888, by the Central Statistical Bureau of Norway, which clearly showed that (for the decade 1871 to 1880) the lowest death-rate for Norwegian girls fell at twelve years, and for Norwegian boys at thirteen years of age. Later I was able to construct the curves of specific intensity of life for Swedes as well as Norwegians of both sexes. For the age period, 0 to 21 years, I have here two comparative charts. One shows the specific intensity of life of Boston, Norwegian, and Swedish boys, and the other contains similar curves for girls. These charts show that Scandinavian children follow the same general law of specific intensity of life as Boston boys and girls. Whether the same law holds for Germans, French, Italians, and English remains to be seen. I have tables showing the same correlations, in general, between growth- and

death-rates among Swedish boys and girls, as I have shown exist in the cases of Boston children. Concerning the growth-rates of Norwegian children, we have no data, that I know of. You will notice that the Boston female's specific intensity of life, from birth to 21, is below that of both Norwegian and the Swedish females, except in the single year, 11 to 12, the year when the Boston girls are growing fastest. During the rest of the period under review, the Scandinavian girls manifest a greater power of resistance to death. A similar state of things appears from the curves for boys. What does it mean? It means, I think, that natural selection, which is rather more active in the case of the Boston population, which is extremely heterogeneous because of immigration, is, as we might expect, attended with a large loss of life. The immigrants who come to us from the older countries are removed thereby from conditions to which they have been acclimated and adapted for generations. Their transplantation to any distant and new environment means a fierce struggle for existence for them, and variation and death for a good many of their children. Boston's highest death-rates are among the foreign born. In the year of most rapid growth, variation is favorable to the Boston child, and his specific intensity of life surpasses that of his Scandinavian rivals temporarily. Can we by care and effort prolong the Boston child's year of greater specific intensity of life into two, three, or five years? We can, at least, preach a hygienic crusade with such an ideal end in view. I believe that adolescence is the period in which strenuous, systematic physical training yields its best results, whether we measure these results by enlargement of organs or by increase and improvement of functional power.

A PROPOSED STANDARD CHART TO SHOW THE PROPORTIONS OF AMERICAN FEMALES.

BY ANNA RICHARDS AND BESSIE BELLE LITTLE OF NEW HAVEN.

The object of this chart is to present a standard to the American girl, or woman, by which she may test her own proportions.

The charts now in use offer no such standard, being a history of composite facts rather than one of ideal, or continuous, typical meas-

urements. For instance, 35 per cent. of the women measured have a calf measurement of 13 inches; 35 per cent. have an ankle measurement of 7.9 inches; a hip measurement of 34.4 inches; a waist girth of 24 inches, and so on. But the same woman does not figure throughout these measurements. You find the proportions of the arms in the 50 per cent. column, her trunk proportions in the 20 per cent. column, and the leg proportions in still another column.

How compare complete measurements of a school girl with such composite averages? Where is there a standard for comparison? Certainly these charts are not understood by the scholars, nor even by many teachers who use them. Is it possible to make a clearer test, which every one "who runs" may not only "read," but comprehend? Our intention has been to place side by side the best proportions of antiquity and those of well-built American women, so that a pupil on receiving her plotted measurements may at once see how far she is above and how far below an established standard. It may be objected that our taking the proportions of ancient Greek statues, and our presuming to judge of the best type of American womanhood, is too arbitrary a proceeding. "Standards differ." "How can anyone establish a criterion for American girls?" These criticisms may be just. Certainly no one person can judge for the multitude. But it seems desirable that physical educators should be trained to recognize physical defects or perfections, and thus become competent to pronounce judgment.

The forty measurements we have collected towards the three hundred and sixty we need, have been selected under the supervision of the instructors of the Anderson Normal school in New Haven. If, out of twenty-five girls, four or five are unanimously chosen by half a dozen critical judges, it seems just to believe that there must be a true standard underlying such judgments.

We chose the Venus di Medici in preference to other antique models on the advice of Professor Weir of the Yale Art school, and also because the Venus of Milo is not a complete figure, since it lacks arms.

Dr. Seaver has tested the measurements which gave us trouble, and we have proved most of them by the charts on "Classic and Human Proportions" by Von Schadow—consulted at Professor Weir's suggestion.

Classification.		Length.		Girth.												
Height.	Weight.	Stretch of arms.	Height sitting.	Head.	Neck.	Chest.	Chest full.	9th rib.	9th rib full.	Waist.	Hips.	Thigh, right.	Thigh, left.	Calf, right.	Calf, left.	Upper arm, right.
5 ft. 3 in..	Venus de Medici..	.....	34.8	....	12.3	33.6	....	29.4	....	27.3	36.6	21.1	21.1	14.1	14.1	11.4
	140-135.....	.....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
	135-130.....	.....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
	130-125.....	.....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
	125-120.....	61.8	33.7	22.4	11.8	29.9	31.5	27.8	29.6	25.5	37.	21.2	21.2	13.8	13.8	9.7
	120-115.....	66.7	31.8	....	12.	29.2	30.9	27.1	28.5	26.	34.6	20.8	20.8	12.9	13.1	10.
		64.2	35.	21.6	12.5	31.	33.5	25.5	29.3	24.	34.	20.5	21.	13.	13.3	10.1
	115-110.....	.....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
	110-105.....	.....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
	105-100.....	60.4	33.	21.6	12.1	31.6	33.2	25.8	28.6	23.3	24.3	20.5	20.6	12.5	12.6	9.3
5 ft. 4 in..	Scale of Venus...	.....	35.3	....	12.5	34.1	....	29.9	....	27.7	37.1	21.4	21.4	14.3	14.3	11.6
	145-140.....	.....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
	140-135.....	68.	....	22.	12.5	32.	35.3	....	....	....	37.	22.5	22.5	13.3	13.5	10.
	135-130.....	65.	35.	21.5	12.6	33.2	36.5	26.9	29.6	25.6	37.9	22.2	22.1	13.8	13.8	10.8
	130-125.....	67.2	33.3	22.4	13.	31.3	34.8	....	....	....	39.3	22.2	22.2	13.7	13.5	9.8
		64.4	33.9	23.	12.5	31.5	33.8	26.2	28.5	....	....	....	....	....	....	10.
	125-120.....	.....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
	120-115.....	66.7	33.9	22.4	12.6	32.	33.6	26.6	27.7	25.2	36.5	21.4	21.2	12.7	13.	10.
	115-110.....	.....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
	110-105.....	65.5	33.9	21.4	11.7	31.2	32.5	26.6	28.9	23.4	33.5	19.5	19.5	13.7	13.7	10.

Girth.							Depth.				Breadth.						Strength.					
Upper arm, right, contracted.	Upper arm, left.	Upper arm, left, contracted.	Fore arm, right.	Fore arm, left.	Wrist, right.	Wrist, left.	Chest.	9th rib.	Waist.	Abdomen.	Neck.	Shoulders.	Chest.	9th rib.	Waist.	Hips.	Back.	Legs.	Chest.	Fore arm, right.	Fore arm, left.	Lung capacity.
....	11.4	....	10.6	10.6	6.5	6.5	7.6	6.1	6.7	7.1	3.7	16.	10.	10.	9.5	12.9	...	...	....	....	...	....
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....	9.5	...	9.	8.8	6.	6.	6.	....	....	7.6	3.7	14.3	....	....	8.7	13.9	75.	80.	30	21	22	160
....	9.9	....	8.8	8.5	5.8	5.8	5.6	....	....	6.4	3.9	14.6	....	....	9.	13.3	60	60	32	24	22	. ..
10.8	9.8	10.4	9.3	8.6	6.	6.	6.9	6.8	6.5	6.5	3.7	14.6	10.	9.1	7.9	11.9	...	...	74	....	...	171
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...	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	...	...	....	....	...	....
10.2	8.9	10.	8.8	8.5	5.5	5.4	6.4	6.2	5.8	5.6	3.6	13.4	10.	8.7	7.2	12.4	...	...	73	....	...	160
....	11.6	....	10.8	10.8	6.6	6.6	7.7	6.2	6.8	7.2	4.1	16.3	11.	10.2	9.7	13.1	...	. .	....	....	...	....
....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	...	...	....	....	...	....
....	10.	....	9.5	9.4	6.4	6.5	7.	....	....	8.2	3.7	15.1	....	....	9.	13.7	...	...	....	....	...	....
....	10.4	....	9.5	9.4	6.2	6.2	7.1	....	....	8.1	4.	15.2	....	....	8.6	14.5	135	125	60	25	23	235
....	9.7	....	9.3	9.	6.	6.	6.9	....	....	8.	3.6	14.6	....	....	8.5	13.3	...	...	85	....	...	....
10.5	9.5	10.2	....	....	....	....	6.7	7.1	6.9	7.6	4.5	14.4	10.6	8.5	8.4	....	...	...	9.3	....	...	158
....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	...	...	....	....	...	....
10.7	10.4	11.1	9.	8.6	6.	6.	6.6	6.	6.1	7.4	4.2	16.1	11.	9.5	9.2	13.2	...	...	75	....	...	146
....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	...	...	....	....	...	....
....	10.	....	9.5	9.4	6.1	6.	6.3	....	....	6.4	3.9	14.8	....	....	8.5	12.9	90	115	37	24	23	205

Our chart, when finished, will be about the size of the one now in use, and will be divided into nine parts for classifying heights from five feet to five feet and eight inches. Each one of the nine divisions has eight subdivisions for classifying weights, since it is apparent that the woman of five feet and three inches weighing one hundred and ten pounds would not be of the same type as one five feet and three inches, weighing one hundred and forty pounds. We print here two height divisions, five feet and three inches—the actual height of the Venus—and five feet and four inches in which we give the measurements of the Venus had she been one inch taller, calculated by proportion. Under each of the eight subdivisions of weight there will be the measurements of five well-built girls or women. Taking the average of each five, we shall construct our ascending and descending scale.

Notice how closely the measurements agree under the same weight, also how similar the measurements of the Americans are to those of the Venus,—not including the trunk measurements in which the former are vastly inferior. This fact emphasizes the results of tight clothing, through many generations, namely, the smaller waists and the larger hips.

We have added certain trunk measurements, depths and breadths of ninth rib, waist, and chest, thinking them significant if there be constriction—the tendency being to lessen breadths and increase depths.

We are at a standstill for want of measurements, and we should be glad to receive assistance and suggestions. We will send a chart to any member of the Association who is able to add to our small stock, and willing to do so.

DISCUSSION.

Dr. Sargent.—I should like to say just a word in regard to the subject of anthropometry. I have made a study of this subject for fifteen years, and the more I hear of these papers the more I am inclined to wait. It seems to me the desirable thing to do is for those of you who are interested in the subject to furnish themselves with a set of measuring rods and tape and dynamometers, and simply go to work. We have heard a great deal to-day from the middlemen in the subject, who have had very little practical experience

in making measurements. I am very glad that some of them are willing to go upon record. At this present time, for myself, I feel some reluctance to do so.

DR. HARTWELL.—I do n't know whether I am one of the middlemen or not; but I do know that it is time we began to look into the anthropometric data that we have and try to learn what they mean. Much of what has been published hitherto is of value. These examinations of Dr. Bowditch's, which were made twenty years ago, related to height and weight. But we do not know yet what happens in regard to increment in height and weight and girth in the earlier and later years of immaturity. We need to know in order to use such data as we have intelligently so as to guide our steps in the future. We need to arrange and rearrange such tables as we have, and to analyze the material out of which those tables are made, according to individual ages, by sex, in order to determine if those things which seem to be valuable are really so or not. There is something very tentative in all this, of course; none of us is so young as not to know that. I wish to call attention to this fact, that Dr. Bowditch's measurements, as they are called, were not made by him; they were not made by trained observers even; they were made by fifty or more masters in the Boston schools, acting under Dr. Bowditch's directions. Yet the resulting curves are quite regular; they have taught us much and may teach us more if we will study them carefully. It would have been a great pity not to publish them. As to charts in general, it is evident enough that there is a good deal of unrelated material in them which may or may not be found hereafter to be of value for our purposes. The sooner we ascertain their real value, the better. I think that this discussion is most timely, and that the bringing forward of these facts and suggestions is of value because they call attention to questions and points of view that might otherwise be neglected.

It seems to me that the papers to-day show more sense of proportion, and a keener desire to find out what all this measuring amounts to and should lead to, than anything we have had hitherto. The question is not, "Are we getting absolutely conclusive and exhaustive data fit to constitute the record for a thousand years?" but, rather, "Are the facts which have been observed and tabulated fit to serve as a guide for our feet and a lantern for our paths for the next ten years?"

DR. SARGENT.—There are a great many young teachers here. They are always waiting with a note-book in their hands; they are after facts,—they want something to rely upon. I want to ask you candidly, If we accept Mr. Moon's conclusions from his facts, that the average strength of the boys in his school is higher than that at Amherst, Harvard, or Yale, where shall we be?—what have we to stand upon?

In regard to Dr. Hartwell's statement. He was very guarded in his remark; but are we to infer that his girl at twelve years of age is capable of standing more work than the boy at this period, and that we should therefore put more work upon her? Every physician in the country will disagree with that statement. The increase may be for a purpose,—the important function that a woman has to prepare for necessitates that she should have greater vitality than a man, and this acceleration in growth at this time may be for a purpose. It seems to me that we have got something to learn yet. I want to repeat again, before we come to any conclusion—and I have always taken this stand—we should work according to some uniform plan in order to get something that we can build upon. Now our charts are being derided and we are throwing away all we have done and going back to the Greeks. One person thinks it necessary, in order to take a strength test, to pad the trousers. Of course such a man can lift a great deal more; but unless others have been allowed the same privilege it is an unfair test and cannot properly be entered in the conclusions at all.

We must take this thing as a matter of business. It seems to me, the sooner we have a commission that will draw up some regulations and rules that all will stick to, the better. Don't let us keep firing into the air and talking of the things we at present know so little about.

DR. HARTWELL.—Within thirty days we will find the commission, if you will furnish the anthropometrists who have statistics to pool.

DR. SARGENT.—This matter may well be taken under consideration by the proposed standing committee on measurements. I want to say that I have been invited from time to time to give up my data, everything that I have been doing in the way of measuring and examining for fifteen years. I think sometimes that I know what I am after, and I think perhaps I may be considered to have

those qualities of human nature that the rest of you have; and when I am asked to give up all my data I think I have a right to hesitate, after hearing some of the conclusions of others, until I can write my own articles and present my own deductions to the public over my own name.

DR. SEAVER.—Do n't you examine a man, take a strength test, quicker than you did three years ago?

DR. SARGENT.—Yes, I think I do; that is due to increased experience. Allusion has been made here to the comparison of strength tests of different institutions. If I remember rightly, Dr. Beyer made some comparison of Annapolis with Yale measurements, to the effect that the average student entering at Annapolis shows a higher strength test than the same man at Yale. I think he was not comparing the man of sixteen at Yale, but simply comparing a percentile grade of sixteen years of age, which he had not correctly interpreted. It does not become us to bring one institution into opposition with another and present comparisons of this kind until we know just what we are talking about. This anxiety to publish before we have carefully weighed both premises and conclusions is a threatening evil that we should try to steer clear of.

DR. BEYER.— . . . We are all glad to be convinced of our errors. It is often through erring that we get good results that will finally prove of value. . . . I think in the strength tests the difference is not so great as to require us to throw them out entirely. I am sometimes very much struck, if I take the class that enters at the Annapolis Naval Academy and take it again after six months, to see how nearly the averages will repeat themselves year after year. The difference that I find with them is not so great as to alarm me as to their reliability. We must investigate, and see the same thing from different points of view, in order to ascertain whether we are correct or not. We are all trying to arrive at the truth and we have a right to choose our own way.

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DR. SARGENT.*—I would like to correct one assertion which Dr. Arnold made in regard to my remarks. I should be sorry to leave the impression in the minds of those present that I was desirous of

* NOTE. Dr. Sargent's remarks at Saturday morning's session, in continuation of this discussion, are introduced here for the sake of congruity.

having everybody stop measuring. I tried to say that I thought everybody ought to begin measuring,—that we all constitute ourselves observers, and when we get our facts we can get together and have something for comparison. I certainly think it would be a good idea for all of us to stop making deductions until we have sufficient material to talk about; that is the ground of my objection. I felt that no one had a right to come before this Association and make any deduction that would lead those who did not know about the subject to draw conclusions that I know they will draw, because these deductions are misleading. I do not think it is just, or treating the younger members as they ought to be treated. I think the materials before this Association should be thoroughly digested and assorted carefully before they are given to the public, especially such technical papers as have been presented this morning.

DR. SEAVER.—May I ask Dr. Sargent if he has in his own mind, or is willing to state, if he has, how many statistics a person ought to have in order to be able to generalize or deduce certain facts in anthropometry?

DR. SARGENT.—While I do not think that you can arrive at anything of great importance by the percentile method, you can get as near the truth with a smaller number as you can by following the average or mean with a larger number, but I should not undertake to deduce anything that I could use for a working basis under 2,000 or 3,000 measurements, although it happens that if you take 1,000 measurements of a student community, either at Yale or at Harvard, the difference between one thousand and another thousand would be hardly perceptible. Of course there would be differences, but they run along very nearly parallel. But the difficulty comes when we undertake to correlate or differentiate them, as it were.

I am very sorry if I left the impression that anthropometric work should be discouraged. The thing that I tried to discourage most decidedly, and I want to be put upon record to that extent, is the making of charts and tables and coming to deductions and conclusions without having sufficient numbers. Now it will be remembered that the chart that I first put out was simply a blank chart, a skeleton chart; few figures were given. I was criticised for not publishing figures. The reason was simply because I did not have enough numbers to draw any conclusions from that I was willing to

stand by. You remember that when we first began measuring we had nothing to go by, no data at all. We were all at sea, and the first thing that I did was to take the first 400 or 500 measurements that I could get and make up what we called an average table. When a boy came to the gymnasium he was told that his measurements were above average or below it. That may signify something to your minds, but it signified nothing to him. If you have a class that are graded on a scale of 100, if one boy stands, for instance, at 95, and another boy stands at 55, both are above average, but what a vast difference there is between them! There may be another standing at 49; he is just below the average, but is a great deal nearer the boy that is just above the average than the one at 25. The differences are so great that it is hardly any information at all to tell a man that he is above or below average. One below would not know whether he stood at 45 or 25. He might keep on toiling in the gymnasium perhaps four years, and yet never get above the average. He has no means of knowing whether he makes any progress at all. I think we got out a table with the first 2,500 or 3,000 measurements, including boys ranging from fifteen to thirty years of age, and used that as a working basis. One boy sees that he is away down in the 25 per cent. line; he says, "I thought I was better than that." He immediately discovers that he is being compared with men of twenty-five and thirty, and says, "I do n't think it is fair to compare a boy of fifteen with a fully developed man of twenty-five." He takes his chart home to his parents, and it would take considerable time to explain to them why he stood at so low a figure. What does that at once suggest to you? You should make a table of different ages. Collect 1,000 boys of fifteen years of age, then you will have some basis upon which to make comparisons. But you will have to wait some time before you will get that number. I had some tables prepared for the World's Fair, of ages ranging from ten up to twenty-six; but concerning the smaller ages I feel doubtful simply because I have not numbers enough to draw any satisfactory conclusions from.

A good many say, "Why not use such material as we do have?" Well, you can; you are doing so; but if I should do the same thing, that would be leavening the whole lump and not be adhering to anything that is going to give us as a body any scientific value. The

scientist says, to our present deductions, "That is all very well, but you have too few measurements; we do n't accept your conclusions at all." What I say is, that we should draw up a uniform plan of collecting material and decide upon a uniform system of measurements. That uniform method having been established we should all go to work and collect the material, bring it together as an association, put it in the hands of an anthropometric committee made up from the association or of such persons as we saw fit to invite from outside, then let them handle the data; and under those circumstances, it seems to me, we can get deductions that would be worth something.

There is another phase of the question. I do believe, with President Seaver, that the time is coming, after we enlarge our organization, so that we can add to our list of measurements, when we can have it understood that certain sections of the community will measure certain parts, and that those parts will be accepted as data to work upon. In that way we can get a good many measurements that we do not get now, and then pool our data. There is very little difference in the type of Americans as they are made up to-day. It is surprising how little. Dr. Seaver's measurements and Dr. Hitchcock's and my own put together on the percentile chart show very little difference, which demonstrates the unity of our type. Those who read the articles I published in *Scribner's* a while ago will perhaps remember the comparison between English and American men and women. In a great many cases the measurements were identical, as shown by the percentile grades.

Dr. Lincoln.—The doctor says there is a serious objection to comparing the strength of a boy of fifteen with that of the man of twenty-five. The reason is obvious. Is there any age above fifteen, possibly eighteen, to put it tentatively, at which you can compare?

Dr. Sargent.—Eighteen for women and twenty-two for men, I should say.

Dr. Lincoln.—And below those you would not care to compare them?

Dr. Sargent.—No; it would not be a just comparison. Men of twenty-two I think would probably average as large as at any age.

Dr. Lincoln.—In normal muscular strength?

Dr. Sargent.—I think a man of twenty-two is in his prime, as far as measurements go.

REPORTS PRESENTED BEFORE THE SECTION ON LITERATURE AND BIBLIOGRAPHY, TUESDAY AFTERNOON, APRIL 25.

[Dr. F. E. Leonard in the chair.]

DR. HARTWELL.—I have to make two reports, it appears; one, on a matter which was referred to a special committee, consisting of Drs. Enebuske, Halsted, and myself, as to the desirability of preparing a classification, under the "Dewey Decimal System," for cataloguing books in libraries. I will speak first of the year's history and literature; but in a general way only, inasmuch as being the junior member of the committee I did not expect to be called on for a detailed report, and have not undertaken to prepare such an one.

So far as I know no new journals in physical training have been started, and no particularly notable new departure in the way of starting normal schools or strengthening old ones has been made. Some new buildings have been constructed. There is one that is worth our attention, because it is likely to be a model for some time to come. It is a new departure in secondary schools—an admirable gymnasium, well fitted up, in the Hyde Park High school, in the city of Chicago. The weak side of our school gymnastics is found in the lack of provision of proper places and adequate apparatus for the gymnastic instruction of adolescents of both sexes. Our school work hitherto has been fairly well adapted to the younger children, in a mild and tentative way; but the clear differences in body and mind between the child and the adolescent, and the characteristic needs which result therefrom, have not been recognized sufficiently by those who have introduced and undertaken to support physical training in the public school system. It is, therefore, distinctly worthy of special mention that there is a high school in Chicago in which the youth are to be instructed in gymnastics of a more advanced nature than those adapted to babes and children.

With regard to the literature in anthropometry, we may say that it has received measurable and important additions during the last year. The anthropometrical papers presented at the meeting of the International Statistical Institute, in Chicago in October, 1893, which are contained in the Quarterly Proceedings of the American

Statistical Association for December, 1893, have been reprinted as a separate pamphlet. They constitute a larger and more scientific set of papers on anthropometry than any other we have in the English language; and they are worth considering on that account, although they are not always found in the list of anthropometrical literature recommended by summer school directors. The pamphlet includes a reprint of Dr. Bowditch's classic paper, which was out of print; it also includes two of Dr. Porter's preliminary papers. In this connection Dr. Porter's very complete paper, "The Growth of St. Louis Children," published in Vol. VI, No. 12, of the Transactions of the Academy of Science of St. Louis, should be brought to your attention, both because of its value and because of its general bibliography. The pamphlet of reprints also contains a bibliography of Anthropometry in the United States, numbering 117 titles, which I prepared. As several interesting papers have appeared since 1893 I propose to revise that bibliography, bringing it up to date as nearly as I can; then if the publication committee of our reorganized association chooses to publish it, it may do so and welcome.

Dr. Porter's papers have provoked a good deal of discussion. Whether Dr. Porter's conclusions be correct or not is not for us to undertake to determine at this time. It is certain that he has done a most admirable piece of anthropometric work, which does not deserve to be characterized as it was by Professor Pearson of London, in one of the November issues of *Nature*, as dilletanteism in anthropometry. Dr. Franz Boas has a critique in a recent number of *Science*, of Dr. Porter's paper. He is unable to agree with certain conclusions of Dr. Porter's; but the manner in which he states his views is unexceptionable. Anthropometrical literature is taking on a new phase. It is becoming more scientific. Theoretical considerations as to the nature of statistics and how they should be treated, presented, and interpreted, are coming more to the front. This is significant and encouraging.

There is another new movement which concerns us somewhat. I mean the child-study movement, the storm center of which is now located in Illinois. A very strong society has been established there, which aims at employing simple anthropometrical methods in its investigations. If we reorganize in the way that has been suggested, we should have a district society in Illinois ready to join

hands with the Illinois Society for Child Study in determining the growth rates of children under ten years of age. The literature of the Illinois Society for Child Study is well worth our consideration. Perhaps the most striking article in the first number of its Transactions is that by Dr. H. H. Donaldson of the University of Chicago, on "Growth in Relation to Training." As students of neuro-muscular physiology and its application to physical training we should be interested in knowing the latest teachings of science, with regard to the order and rate of development of the different parts of the brain, sensory and motor. Dr. Donaldson's treatment of this subject in his forthcoming book on "The Growth of the Brain," in the Contemporary Science series, is sure to be fresh and instructive.

Mr. Johnson, one of the scholars of Clark University, has made a careful study with regard to the educational value of plays and games. It was published in the *Pedagogical Seminary* of last September. The article is thorough-going and suggestive. In many ways it is the best of its kind that has appeared in English. Our own proceedings have so recently appeared that I venture to call attention to them as part of the literature of the year.

There is no very large amount of literature that I have discovered, with regard to the working of the Ohio law, which makes physical training compulsory in the schools of certain cities in that state. The meeting of physical educationists recently held in Ohio may lead to an increased discussion of the policy of stimulating sluggish public opinion by legislative goads. Among the current news that one finds in the newspapers, we will call attention to the attempt in Massachusetts to induce the legislature to pass a law, making physical training compulsory in cities of a certain grade. It failed for lack of thorough-going support, and because of the belief that such a law was likely to prove an inoperative failure.

In the department of governmental publications on the subject of physical training, the most important report I know of is that made not quite a year ago by the Italian Government Commission. The commission is engaged in preparing a carefully devised code of gymnastics for school work. It is the kind of a commission which ought to be appointed on such subjects. It includes physiologists and other scientific men, and administrative officers representing the government in educational matters. The report alluded to is a prelimi-

nary report, and we may look for further literature from the same source.

The third number of the Year-Book of the "Central Committee for the Promotion of Youthful and Popular Sports in Germany," has been issued within the past year. As the official organ of a powerful and well-directed movement for the development and spread of out-of-door and popular sports, to supplement and reinforce school gymnastics, this year-book is well worth our attention. The popularizing of out-door games has enlisted the favor and support of the best men in governmental and educational circles in Germany to an extraordinary degree. Would that our statesmen and educational leaders were half as wise or active!

The Germans have already reached the point of holding courses, in their normal schools, for training teachers of gymnastics to be leaders of the children on the play ground, as well as in the gymnasium.

The "Encyklopädisches Handbuch des Gesamten Turnwesens" is still in course of publication in separate parts. It is the most comprehensive work relating to physical training ever undertaken in any language, I believe. It is copiously illustrated. Its editor is Dr. Carl Euler, who is at the head of the "Royal Normal School for Training Teachers of Gymnastics," in Berlin, perhaps the leading writer on "Turning" in the world. I suppose that this truly encyclopædic work will be completed during the coming year; but I imagine it will be many years before it is translated into our language.

Mention should also be made of Dr. Angelo Mosso's recently published "Bodily Education of the Young." The original is in Italian, but it has been translated into French and German. The author is professor of physiology in the University of Turin, and is well known from his investigations "On Fatigue." His paper on "The Physical Training of Woman," was one of the leading contributions to the programme of the Congress on Physical Training, which was held in Chicago two years ago. An abstract of that paper is contained in the proceedings of the National Educational Association of 1893, a portion of which was reprinted as our proceedings for that year, you will remember. Dr. Mosso's book is not, perhaps, quite what we should have expected of so scientific a physiologist as he is known to be. His characterization of German and Swedish gymnastics is disappointing. He appears to have gotten his ideas concerning mod-

ern "Turnen," at second hand. It is a very interesting and suggestive book, nevertheless, and will doubtless lead to lively controversy, especially in Germany. It throws fresh light upon the early history of physical training in Italy. It shows that gymnastics had a hold and beginning there so long ago as the latter part of the fourteenth century. This is hardly surprising, since the standard medical work, "De Arte Gymnastica," was published in Italy, and was written by an Italian physician, Hieronymus Mercurialis. It should be said that Mosso, who is a member of the Government Commission alluded to above, is in search of a system of physical training adapted to the youth of Italy. Such German gymnastics as he has seen, *in Italy*, he does not like, and he appears to think well of some features of Swedish gymnastics because they are well spoken of in France. He is averse to military gymnastics, and sympathizes with the French effort to acclimatize athletics. His book is evidently written for the Italian rather than a continental or world-wide public. Italian youth, like the French, are apparently little given to out-door pastimes, and have been too much subjected to pedantic and arid gymnastic drill.

The Committee of Fifteen, chosen by the National Educational Association to report on the Correlation of Studies in Elementary Education, made its report at the Cleveland meeting of the Department of Superintendence a month ago. Dr. Harris has a weighty word to say with regard to the nature of gymnastics. He recognizes clearly, as all of us should, that physical training in school is a branch of school training, not a branch of school play—that it is not put there for fun, and any one who teaches it merely in a spirit of fun teaches it out of its relation to other subjects and objects of instruction. In other words, gymnastics cannot take the place of recess, or recess take the place of gymnastics, as is often thoughtlessly alleged. Dr. Harris makes this point clear, and his influence among the administrative school officers of the country is so great that the fact of his having recognized and clearly stated this point is of much importance. We can fall back on his statements when people say, "Well, our children don't like gymnastics," as if that settled the question as to the value of school gymnastics.

The primary question is, Are school gymnastics good for the children?

Of course the teacher who can teach gymnastics in an interesting, lively way, will secure better results than will the listless, mechanical teacher; and the same is true of instruction in language, number, or geography. If you find that your children are habitually tired out when they take their gymnastics it means that you have an unscientific and insanitary course of study, and you might just as well drop geography or reading, or condense them, as to take that course with gymnastics. If you are to get educative results you must follow educational methods. If you want merely an explosion of "animal spirits," provide the proper conditions for such an explosion on the play-ground, not in the school-room or the school gymnasium.

Every member of this Association should secure a copy of the report of the United States Commissioner of Education, Dr. Harris, for 1891–'92, which is just out. The first part of the report, that which is addressed to the Secretary of the Interior by Dr. Harris, contains a fairly full discussion of "The Indirect Effects of Exercise," which was Dr. Harris's theme in a paper read before this Association at Philadelphia. Physical training is the only topic which the commissioner discusses at length in this report. Dr. Harris's discussion, taken in connection with Chapter XIII of the body of the report, written by Mr. J. C. Boykin, one of Dr. Harris's expert subordinates, constitutes the most considerable contribution to the literature of physical training which has appeared in this country in recent years. The report is rich in historical material which has been laboriously and carefully brought together. Within its covers you will find a great deal which cannot be found within the covers of any one book in any language that I know of. Mr. Boykin has made a special study of physical training in city schools in the United States, and his statistical tables set forth much fresh and interesting information.

Another fresh book is "A Sporting Pilgrimage, Harper Brothers, 1895," by Caspar Whitney, the athletic editor of *Harper's Weekly*. It is attractively illustrated and contains a very great deal of interesting and well-prepared material, relating to various British sports. What the author has to say upon football, rowing, and university athletics is well worth the attention of all who would know how it is that English sports are carried on in the spirit of the

amateur and good fellow without degenerating into professionalism.

This year may be characterized as the year of "the great awakening," with regard to football. There has been a great deal written upon that subject. The papers were never fuller of their peculiar style of literature upon football, its beauties and its horrors, than during the past autumn and winter. The last Springfield game has given rise to a vast amount of controversy and discussion as to the value of athletics in general, and football in particular. The defenders of football were never more jejune or inconclusive, and its critics never so numerous or more outspoken. President Eliot's indictment of the game in his last report is well worth reading by every one who is interested in maintaining clean sport. It is couched in very vigorous language. Its reference to certain features of football reminds me of the utterances of another Eliot, *i. e.*, Sir Thomas Elyot, who wrote what has been called the first treatise on moral philosophy written in the English language. It was published so long ago as 1531. In his "Boke called the Governour," Elyot expresses the opinion that "footeballe" ought to be "utterly abjected by all noble men." In football he finds "nothing but beastly furie and exstreme violence, whereof procedeth hurte, and consequently malice and rancour do remaine with them that be wounded; wherefore it is to be put in perpetual silence."

The history of football is simply the history of a series of ups and downs, of attempts at regulation, and of attempts, more or less successful, I am bound to say, to escape regulation. Just at present we may conclude, in view of the fact that some of the most devoted exponents of football have been so incautious, in a smoke talk, as to admit that President Eliot is practically right in his criticisms, and that the game must be regulated, that we are approaching a period of regulation and comparative silence upon the subject. To my mind one of the most significant facts with regard to the present discussion of the athletic question, is the almost universal failure of both the apologists and critics of athletic abuses to recognize the teachings of experience as to the value of gymnastics as a branch of physical education.

The history of popular and school gymnastics in Germany, and even in the United States, is practically unheeded by those who

guide and control our colleges and secondary schools. I am sometimes inclined to believe that our educational leaders are for the most part cheerfully ignorant of the fact that gymnastics and athletics have a history, and an instructive one. How else shall we explain the ludicrous and abject failure of school and college teachers and governors to evolve order out of the athletic and gymnastic chaos, over which they nominally preside?

If this Association is reorganized in the way in which it has been voted to reorganize it, I believe we can do much towards spreading a knowledge of the history and literature of physical education. The proprietor of the *Gymnasium*, one of our periodicals devoted to physical training, recently expressed his readiness to publish announcements and notices of books and articles, using such a system of classification and typography as this committee might recommend. It seems to me that the suggestion is a helpful one. There are three monthly journals in the country that are more or less entirely devoted to physical training. All of them notice books. By combining their notices in an annual supplement, the publishers of *Physical Education*, *Mind and Body*, and the *Gymnasium*, could greatly aid towards securing the publication of a bibliography of current literature in physical training, which should prove useful to all of us. The work of the committee on publication and information should be made a prominent feature of our reorganized and rejuvenated Association.

A special committee, consisting of Dr. Enebuske, Dr. Halsted, and myself, was chosen at New Haven to consider the Dewey Decimal system of classification of books in libraries, and to report as to the desirability of using it in classifying the literature of physical education. We communicated with Mr. Dewey, the inventor of this particular system, saying that we were appointed to represent the Association in the matter, and should be glad to receive information and suggestions from him. We have been vouchsafed no reply. As to the merits of this particular system, after hearing the opinions of professional librarians and other persons who have had practical experience in cataloguing and handling books, we are led to conclude that the system, being troublesome and elaborate, is not well adapted to our purposes, *i. e.*, to the handling of a comparatively small collection of books, numbering only a few hundred. As the

literature with which we are dealing is not likely to number more than a few hundred volumes in any library that we have access to, it seems inexpedient to take any further action at present with regard to the Dewey system. We therefore recommend that the card catalogue system be used.[1]

THE VALUE OF STRENGTH TESTS IN THE PRESCRIPTION OF EXERCISE, AND A COMPARATIVE STUDY OF THE STRENGTH OF INDIVIDUAL GROUPS OF MUSCLES, AND OF HOMOLOGOUS MUSCLES, IN MEN AND WOMEN.

BY J. H. KELLOGG, M. D., OF BATTLE CREEK, MICH.

It will doubtless be admitted by all who have undertaken to make a scientific application of exercise as a means of physical development that the dosage of exercise, or in other words, the preparation of a day's order, or programme, is a question which gives to the trainer more perplexity, than any other subject relating to physical training.

Some twenty years ago, in taking charge of an institution for the treatment of chronic invalids, I was at once confronted by this difficulty in attempting to make a practical application of exercise as a therapeutic means. It will be readily recognized that the adjustment of the amount of muscular work to the condition of the subject, is a matter of much greater difficulty when dealing with invalids, than in dealing with that class of persons who usually come under the care of the physical director, since it is very exceptional to find among adults a person whose habits of life have not been such as to allow important muscular groups to fall into a state of idleness. This is well attested by the fact that such deformities as hollow chest, round shoulders, prominent abdomen, curvature of the spine, forward carriage of the head, and similar abnormalities are so prevalent that the majority of men and women who have

[1]The outline of rubrics suggested by the committee at the meeting held in New York will be referred to the new National Council for revision and adoption.

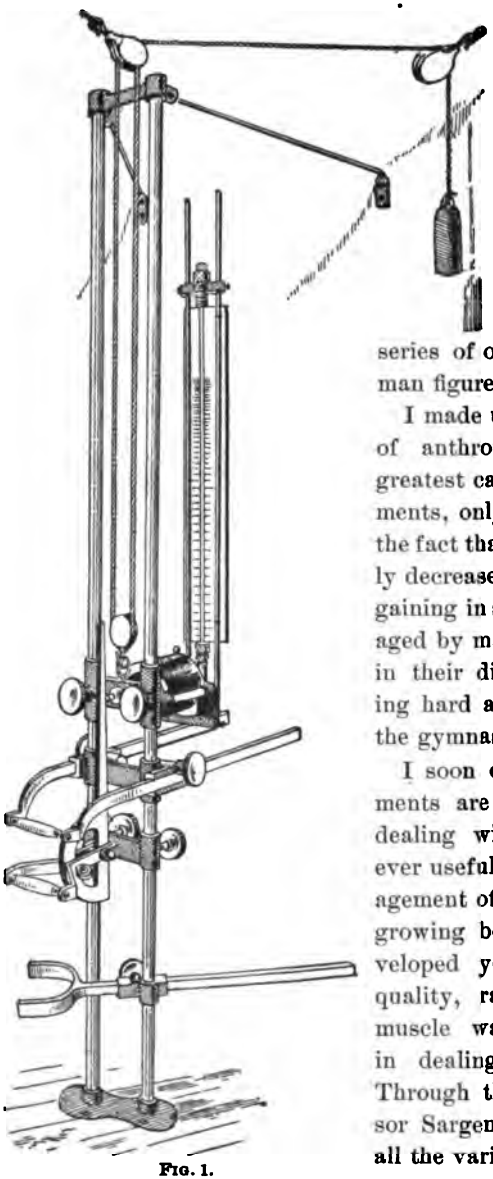


FIG. 1.

reached the age of forty years or over, furnish illustrations of one or more of these defects. Among chronic invalids especially, it is exceptional to find a person who does not present asymmetry in some of the forms which I have shown in a series of outline studies of the human figure, presented elsewhere.[1]

I made use of the usual methods of anthropometry, exercising the greatest care in taking my measurements, only to be disconcerted by the fact that patients not infrequently decreased in measurement while gaining in strength, or were discouraged by making little or no change in their dimensions, notwithstanding hard and persevering efforts in the gymnasium.

I soon discovered that measurements are of very little value in dealing with adult invalids, however useful they may be in the management of the physical training of growing boys and girls and undeveloped youths. I learned that quality, rather than quantity, of muscle was the important thing in dealing with invalid adults. Through the assistance of Professor Sargent, I possessed myself of all the various forms of dynamome-

[1] "Outline Studies of the Human Figure, Comprising 118 Figures, which Embody the Results of Several Thousand Observations, Embracing Studies of a Number of Different Civilized and Uncivilized Races."

ters which had been constructed for use in testing the strength of the muscles of the human body. I found, however, that these dynamometers had so little range of adaptability that only a few muscular groups could be studied by their aid; and, finding myself daily embarrassed in consequence of my inability to meet the requirements of my patients, and being unable to avoid most unhappy blunders in my exercise-prescriptions, in sheer despair I sought to devise some accurate means for testing the strength, which could be adapted to the principal muscular groups of the body.

After seven or eight years' experimentation, I succeeded in perfecting a dynamometer by means of which the strength of every important group of muscles of an individual can be tested.

This instrument I have elsewhere described. I have one here for exhibition.[1] By means of this apparatus, the strength of each of the following muscular groups may be accurately determined: For the upper extremities, hand flexors and extensors, forearm pronators and supinators, arm flexors and extensors, deltoid, latissimus dorsi, pectorals, and shoulder retractors; for the lower extremities, foot flexors and extensors; leg flexors and extensors, thigh flexors and extensors, thigh abductors and adductors; for the trunk, anterior, posterior, and right and left lateral muscular groups; for the neck, anterior, posterior, and right and left lateral muscles; for the thorax, the force of waist and chest expansion. Expiration and inspiration are also measured by means of Waldenburg's pneumatometer. I have worked out a definite mode for testing each group of muscles. This method is followed with care in each test made. The general principle which I have followed is that the resistance of the dynamometer should be applied at the distal end of the bone which is operated upon by the group of muscles under examination, and in such a manner as to give the muscle an opportunity to act to the best advantage, at the same time isolating its action from that of other groups which might vitiate the results obtained.

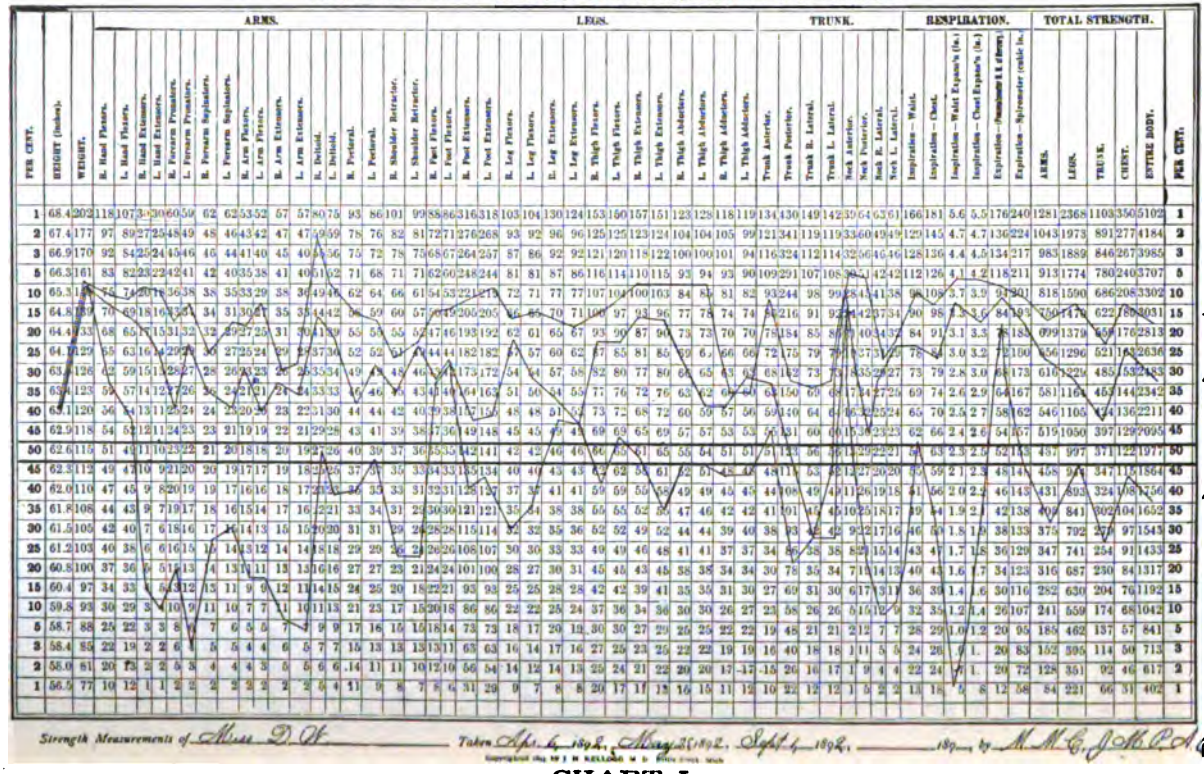
The accompanying physical charts (Charts I and II) are reduced copies of those which I use for recording the condition of the muscular system of my patients. These charts are constructed on a percentile plan somewhat similar to that followed by Professor Seaver in his anthropometric chart. In making these charts, based upon the examination of six hundred men and a like number of

[1] See Fig. 1.

PHYSICAL CHART

Arranged from the results obtained in testing the strength of the individual groups of muscles in 600 WOMEN, by means of a Universal Mercurial Dynamometer, made and compiled under the direction of J. H. KELLOGG, M. D., Superintendent of the Sanitarium and Hospital, Battle Creek, Michigan.

Except when Otherwise Indicated, Quantities are Expressed in Pounds Avoirdupois.



Strength Measurements of Miss D. K. Taken Apr. 6, 1892. May 2, 1892. Sept. 1, 1892. ——, 189—, by M. M. C. J. H. K. M. D.

Sept. 1, 1892.

May 2, 1892.

Apr. 6, 1892.

CHART I.

women, the figures obtained for each group of muscles were arranged in a column in regular order, from the highest to the lowest. The average of 50 per cent. of those found in the middle column was obtained, and put down in the centre of the corresponding column on my chart. Forty-five per cent. reaching 5 per cent. above the upper level of the middle 50 per cent. were next added together, the average found, and the result placed in the same column, just above the previous result. Forty per cent., 35 per cent., and so on down to 1 per cent. of the numbers above the middle, were cut out in like manner, the averages found, and the results properly placed. Proceeding in a similar manner, the figures were obtained for the lower half of the column. By treating the data obtained for each group of muscles in the body in this manner, I have obtained a chart upon which I can make a graphic representation of the strength of the body, just as bodily dimensions have heretofore been graphically represented in anthropometric charts and tables.

At the right hand side of the chart are arranged columns for the totals of the arms, legs, trunk, chest, and the entire body, so as to bring under the eye at a single glance both the relative and the actual strength of the principal divisions of the body.

I have also prepared two other sets of tables, one based upon the examination of two hundred healthy men between twenty and thirty years of age, the other upon the data obtained from testing an equal number of women of the same age. This chart differs from the other chiefly in that the figures start at a higher level. In transferring the graphic representation of a person's muscular strength from one of these tables to another, I find that the characteristic features, although slightly modified, always remain the same.

As a further test of the value of the chart, I have plotted the figures obtained for the various groups of muscles, and find that excellent curves result. In the case of the left foot flexors, for example, an almost absolutely perfect binomial curve is obtained. The best test, however, of the value of this method of obtaining a basis for a prescription for exercise, is the fact that it meets in a most admirable manner the purposes for which it was designed.

The data afforded furnish exact information concerning the capacity of each of the principal groups of muscles in the body. Knowing the capacity of each muscle, it is easy to proportion the work so

as to secure symmetry of development. My plan for accomplishing this is as follows:

Taking 300,000 foot-pounds, one sixth of a full day's work, as the proper daily amount of exercise for a man whose total strength-capacity is 10,000 pounds, corresponding very nearly to the greatest capacity shown upon my table prepared from two hundred young men in vigorous health, I have undertaken to establish a definite relation between the strength-capacity and the total amount of work to be performed. This is accomplished by simply dividing the total amount of work done, by the total capacity of the muscles; that is, 1,800,000 is divided by 10,000, giving 180. In other words, for each pound of capacity, the muscles are capable of doing 180 foot-pounds of work daily, an interesting physiological fact thus for the first time determined. One sixth of 180 is 30. Hence it is clear that in a symmetrically developed man, with a total strength-capacity of 10,000 pounds, each muscle, in order to do its proportion of the 300,000 foot-pounds prescribed, must do work to the amount of thirty times its lifting capacity represented in foot-pounds. It is only necessary, then, in order to ascertain the exact amount of work to be done by each group of muscles at each level, to multiply by 30 the figures of each column of the chart.

I have made a careful approximate calculation of the amount of work done in each exercise or set of exercises, with each apparatus in the gymnasium under my supervision. Knowing the amount of work required for each individual and for each set of muscles, and also the result obtained from each exercise, it is easy to construct tables of exercises exactly adapted to any capacity. I have arranged ten series of such tables, or day's orders, five for each of the two charts.

In making a prescription for exercise, I first note the total capacity of the individual, and then write down a number indicating the day's order which would secure for an individual of the given capacity the proper amount of work. Then, glancing over the chart, I note the low points, and check or underscore each of these, which indicates to the assistant in the gymnasium, that the work is to be doubled on all such points, so as to secure to the weak muscles such rapid development and growth as will enable them to overtake the rest of the muscles. In practice, I find that this method never

results in giving to a muscle more than a full day's work, and consequently there is no danger of injury resulting from this doubling of the amount of work to be done by the weak muscles. In case of complete paralysis of the muscle, it is of course necessary, at the beginning, to administer the exercise by electrical or mechanical means.

As a rule, I find it sufficient, for practical purposes, to divide the series of total capacities represented upon my table, into five groups, instead of making a distinct schedule of work at each of the levels indicated by the several quantities representing total muscular capacity.

The ratio which I have established between the muscular capacity and the day's work is probably too small for persons in vigorous health; but I find it well suited to invalids or semi-invalids. The man who is in training, and desires to develop his whole body to its highest capacity, should be required to execute a full day's work—1,800,000 foot-pounds, or even more. In arranging a day's order of exercise, due account is, of course, taken of the work done in walking, running, and similar exercises, which may be made a part of the programme.

The patient does not undertake the first day to do all the exercises prescribed in the series, but gradually takes them up from day to day as he learns them, and becomes able to do them; and by the end of two or three weeks, he is expected to have thoroughly mastered all the exercises given him, and to have become able to take each day all that is directed in his prescription. At the end of a month, another chart is made, the changes noted, and a new prescription prepared according to the requirements. It is a matter of frequent observation that the points which at the first examination are lowest on the chart, are so improved by the specific exercise directed to the particularly weak muscles that they become the highest ones upon the second chart.

The advantages of this mode of studying the condition of the muscular system, and the great change which may be effected by a precise and definite prescription for exercise, in combination with massage and manual and mechanical Swedish movements, is well shown in Chart I, which represents the muscular condition of a young woman at three different dates; respectively, April 6, May 2,

and September 1, 1892. The great irregularities of the first tracing, and the low levels reached by many of the arm groups of muscles, with the low level of the total strength, indicate a very weak and asymmetrical development at the beginning. The young woman stooped, was round shouldered, hollow chested, pale, anaemic, and possessed of very little vigor. Less than a month later, when the second tracing was taken, the patient had made a gain of nearly 800 pounds in total strength, the greater part of the gain having been made in the arms, which in the beginning were very much weaker than the legs, but which by special attention had become proportionately stronger than the legs. The chest had gained even more than the arms. At this time another prescription was made, the effects of which appear in the further improvement shown by the test made September 1. By comparison of the totals, it will be seen that the asymmetry had largely disappeared.

No person is ever found whose chart gives a perfectly straight line; but the nearer the approach to a straight line across the chart, the more perfect, of course, the symmetry.

At the time of the last test, September 1, this asymmetrical, feeble young woman would certainly have been pronounced one of more than average vigor and symmetry. She carried herself erect, her chest had become full and the respiratory movements deeper, and the whole body shared in the increase in physical vigor and stamina acquired by the muscular system.

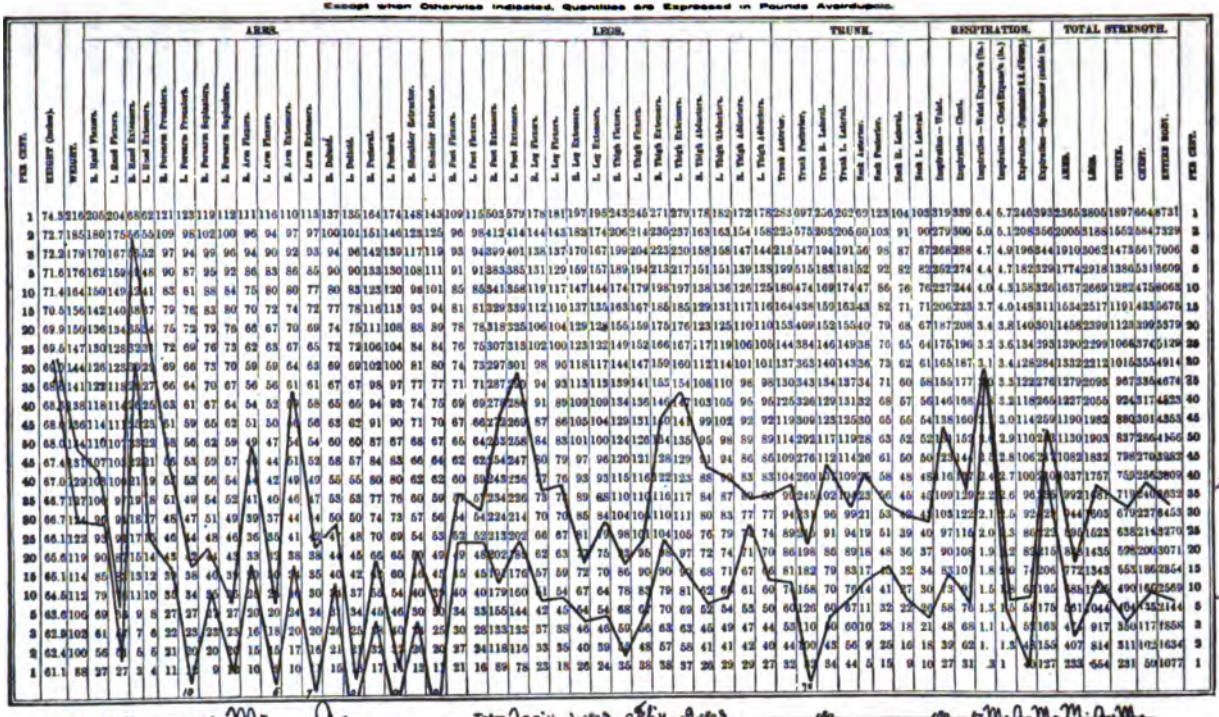
By means of this method, it is possible to obtain exact knowledge respecting the requirements of each individual case. It is possible to make, in less than a minute's time, a prescription which is more perfectly adapted to the needs of the individual examined, than could be made by the most elaborate and prolonged study, without the aid of the accurate data obtained by this method.

One of the charts herewith presented, that of Mr. A. (Chart II), shows the value of this mode of investigation in the diagnosis of morbid conditions affecting the motor system. The patient was suffering from paresis of the left arm. This would be apparent from the chart alone, without other evidence. The dynamometer picks out the particular groups of muscles which are affected by paresis or paralysis, and thus gives important indications respecting the location of the central lesion, of which the paralysis is merely a

PHYSICAL CHART

Arranged from the results obtained in testing the strength of the individual groups of muscles in 600 MEN, by means of a Universal Dynamometer, made and erected under the direction of J. H. KELLOGG, M. D., Superintendent of the Sanitarium and Hospital, Battle Creek, Michigan.

Except when Otherwise Indicated, Quantities are Expressed in Pounds Avoirdupois.



Strength Measurements of _____ Taken January 1892. Feby. 9 1892. _____ 189_ _____ 189_ by M. A. M. M. A. M.

CHART II.

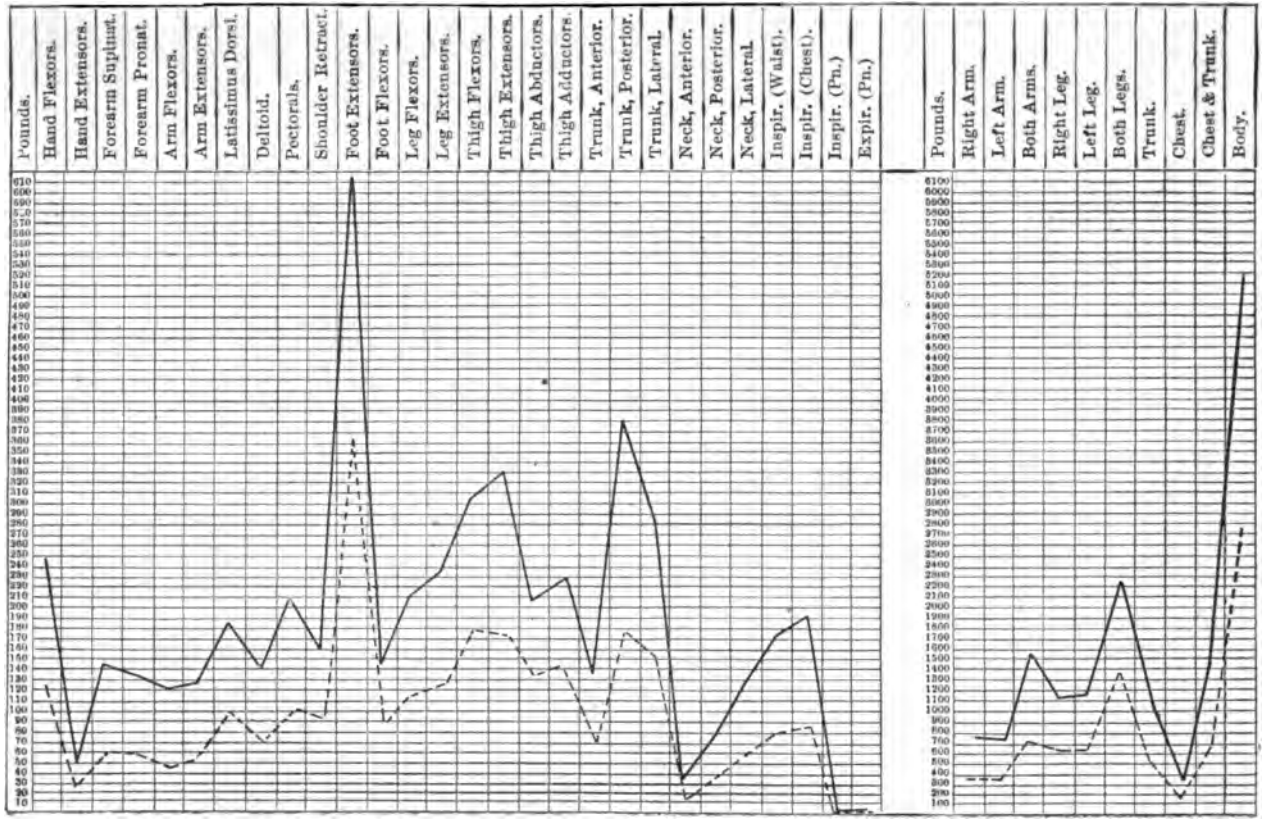
symptom. This chart also shows, in a most interesting manner, the value of the dynamometer as a means of indicating the progress made by a paretic patient under treatment.

Another advantage in this mode of studying the motor-apparatus is the fact that the dynamometer tests not only the muscles, but the nerves and nerve-centres as well, so that it is a precise measure of the condition of the individual's motor-apparatus. It is a true measure of the dynamic energy of the body, and shows the actual ability of the individual to manifest energy through his muscular system as a whole, and through each particular part of it. The tape line merely gives the dimensions of a man,—it tells nothing as to whether he is alive or dead. The dynamometer gives us an accurate description of the living, active man. The chart obtained by means of the dynamometer enables the physical director to make a precise prescription for exercise without even seeing the subject, whereas the data furnished by the measurements of the tape line may relate to a man who is dead, or so completely paralyzed that all forms and degrees of exercise are alike impossible; so that without the aid of the dynamometer, anthropometry is a most unreliable and almost useless guide, unless the subject is before the director, who even then is obliged to depend upon his intuitions and experience in arranging a programme for gymnastic work, rather than upon indications furnished by the tape.

After several years' use of my dynamometer and the charts which it has enabled me to prepare, I am so thoroughly dependent upon these means of directing the gymnastic work of my patients that I should be quite at a loss to know how to prescribe for them without this or some other equally good means of exact diagnosis.

A most interesting line of research which the dynamometer has enabled me to undertake, is a comparative study of the muscular system in men and women. The studies of this subject heretofore made have been chiefly based upon the results obtained by the use of the tape line. A few studies have been made by Quetelet and others, based upon such incomplete tests as the strength of the grasp of the hand, the weight which can be dragged over a level surface, etc.; but the facts presented have been so fragmentary as to be of little practical value.

GRAPHIC 1.—A Graphic Representation of the Actual and Comparative Strength of Each of the Principal Groups of Muscles in the Average Man and the Average Woman. Man ———; Woman – – – –.



In my personal studies by the aid of the dynamometer, the principal comparisons which have been made are as follows, the figures given (Table I, columns I–XIII) being based upon the study of two hundred healthy young men between the ages of eighteen and thirty years, and an equal number of healthy women of the same ages. See headings of the divisions of the table. The table also enables us to compare at a glance:

1. The strength of each group of muscles as compared with the antagonizing group.
2. The strength of the muscles of the arm as compared with the homologous, or corresponding, muscles of the leg.
3. A study of the muscular strength of men as compared with that of women of the same height.
4. A study of the muscular strength in short men and short women as compared respectively with that of tall men and tall women.

In Table I will be found the figures indicating the principal of these relations, which are made more evident by a series of graphic diagrams presented below.

The Relative Strength of the Various Groups of Muscles.—In Table II the figures which indicate the strength of each individual group of muscles for the average man and the average woman, are arranged in the order of their relative strength. It will be observed that the order in the two columns is not the same. Interesting differences and facts, a few only of which will be mentioned here, occur at many points,—

1. One of the most curious facts to be noted is that the foot extensors or calf muscles, in the average woman, have a strength almost exactly equal to that of the left arm.
2. The anterior muscles of the neck, in both men and women, have about half the strength of the posterior.
3. The hand flexors in men have just twice the strength of the arm flexors; in women, the hand flexors are nearly three times as strong as the arm flexors.
4. In man the forearm supinators are considerably stronger than the pronators, whereas in women they are of equal strength, although much weaker than in man, who is $2\frac{1}{2}$ times as strong as in the average woman.

TABLE II.

TABULAR ARRANGEMENT OF THE SEVERAL GROUPS OF MUSCLES WITH REFERENCE TO THEIR RELATIVE STRENGTH.

MEN.		WOMEN.	
Muscles of Inspiration (pneumatometer)	.9	Muscles of Inspiration (pneumatometer)	.4
Muscles of Expiration (pneumatometer)	2.6	Muscles of Expiration (pneumatometer)	1.4
Neck Anterior	35	Neck Anterior	19
Hand Extensors	54	Hand Extensors	29
Neck Posteriors	75	Neck Posterior	37
Arm Flexors	120	Arm Flexors	48
Neck Lateral	126	Arm Extensors	53
Arm Extensors	127	Forearm Supinators	57
Forearm Pronators	134	Forearm Pronators	57
Trunk Anterior	139	Neck Lateral	60
Deltoid	140	Deltoid	71
Forearm Supinators	143	Trunk Anterior	73
Foot Flexors	145	Inspiration (waist)	79
Shoulder Retractors	160	Inspiration (chest)	85
Inspiration (waist)	172	Foot Flexors	89
Latissimus Dorsi	185	Shoulder Retractors	95
Inspiration (chest)	190	Latissimus Dorsi	99
Leg Flexors	200	Pectoral	102
Thigh Abductors	206	Leg Flexors	116
Pectoral	209	Leg Extensors	123
Thigh Adductors	227	Hand Flexors	125
Leg Extensors	237	Thigh Abductors	135
Hand Flexors	249	Thigh Adductors	142
Trunk Lateral	287	Trunk Lateral	154
Thigh Flexors	303	Chest	166
Thigh Extensors	330	Trunk Posterior	173
Chest	365	Thigh Extensors	174
Trunk Posterior	380	Thigh Flexors	179
Foot Extensors	614	Left Arm	363
Left Arm	751	Foot Extensors	364
Right Arm	770	Right Arm	373
Trunk	1042	Trunk	516
Right Leg	1131	Left Leg	659
Left Leg	1131	Right Leg	663
Chest and Trunk	1407	Chest and Trunk	682
Both Arms	1521	Both Arms	736
Both Legs	2262	Both Legs	1322
Entire Body	5190	Entire Body	2740

5. In man, the latissimus dorsi and the muscles which move the upper chest in inspiration, are equal in strength; while in woman a similar parallel exists between the latissimus dorsi, the pectorals, and the shoulder retractors.

6. The inspiratory powers of the waist and chest are practically equal in woman; while in man the inspiratory power of the chest is perceptibly greater than that of the waist, although in each case the respiratory strength in man is double, or more than double, that of woman. This fact demonstrates the fallacy of the idea that restriction of the waist is a means of giving woman a superiority in upper chest development, and so acting as a preventive of pulmonary disease. Men, without waist constriction, have greater relative strength in the upper chest than have women.

7. The total strength of inspiration (chest) is, in women, just one eighth that of the total for the chest and trunk.

8. The waist-expanding capacity is almost exactly one half that of the total for the two sides of the trunk, in woman.

9. The strength of the arm extensors, in men, is almost exactly one twelfth that of the entire arm.

Many other interesting comparisons might be made, especially those which relate to the strength of each group of muscles as compared with the whole body. This is graphically shown in one of the diagrams referred to.

The Strength of Each Group of Muscles in the Average Woman as Compared with the Corresponding Group in the Average Man.— (Table I, column III.) By referring to Graphic I, in which is shown the actual strength of each group of muscles in the average woman as compared with the corresponding group in the average man, the strength of man being taken as unity, it will be seen at once that the strength of the average woman falls far below that of the average man. Inspection of the Graphic will at once suggest many interesting comparisons.

The reasons for the unusual weakness of certain groups of muscles in women are, in some instances at least, quite apparent. The weakness of the arm muscles, for instance, is explained by the fact that women engage less than do men in laborious employments. The legs are relatively stronger than the arms in women, for the reason that the amount of exertion by the legs is more nearly equal in the two sexes than in the case of the arms. The greater strength of the thigh flexors is, perhaps, due to the fact that the bones of the legs are, in women, shorter than in men, so that the muscles acting upon the thigh have a better leverage than in men. The same reason will

hold good for the thigh abductors and adductors, which are relatively the strongest muscles possessed by the average woman. The greater width of hips perhaps affords another anatomical advantage to the muscles of the thigh in women.

These observations are entirely in harmony with the interesting fact pointed out by Quetelet and Sargent that the thigh is not only proportionately, but actually, larger in women than in men. The thigh is found to be relatively larger even in girls of twelve, and in girls of fifteen it is two inches larger than in boys of the same age. Increase in the size of the thigh is, in fact, one of the very first of the sexual characteristics of a physical nature which appear as the girl approaches puberty. It is interesting to observe that the results obtained by the dynamometer entirely coincide in this particular with those noted by anthropometry.

Heretofore there has been no means of knowing whether the larger thighs of women were the result of a greater proportionate development of the muscles, or simply a greater accumulation of adipose tissue. It is probable that both peculiarities in structure are present, but the dynamometer has clearly shown that the thighs in women are not only larger, but proportionately stronger, as compared with other muscles, than in men. As compared with men, the abductors are stronger in women of equal height, than in the average woman, the relation being 72 per cent. for the former as compared with 65 per cent. for the latter.

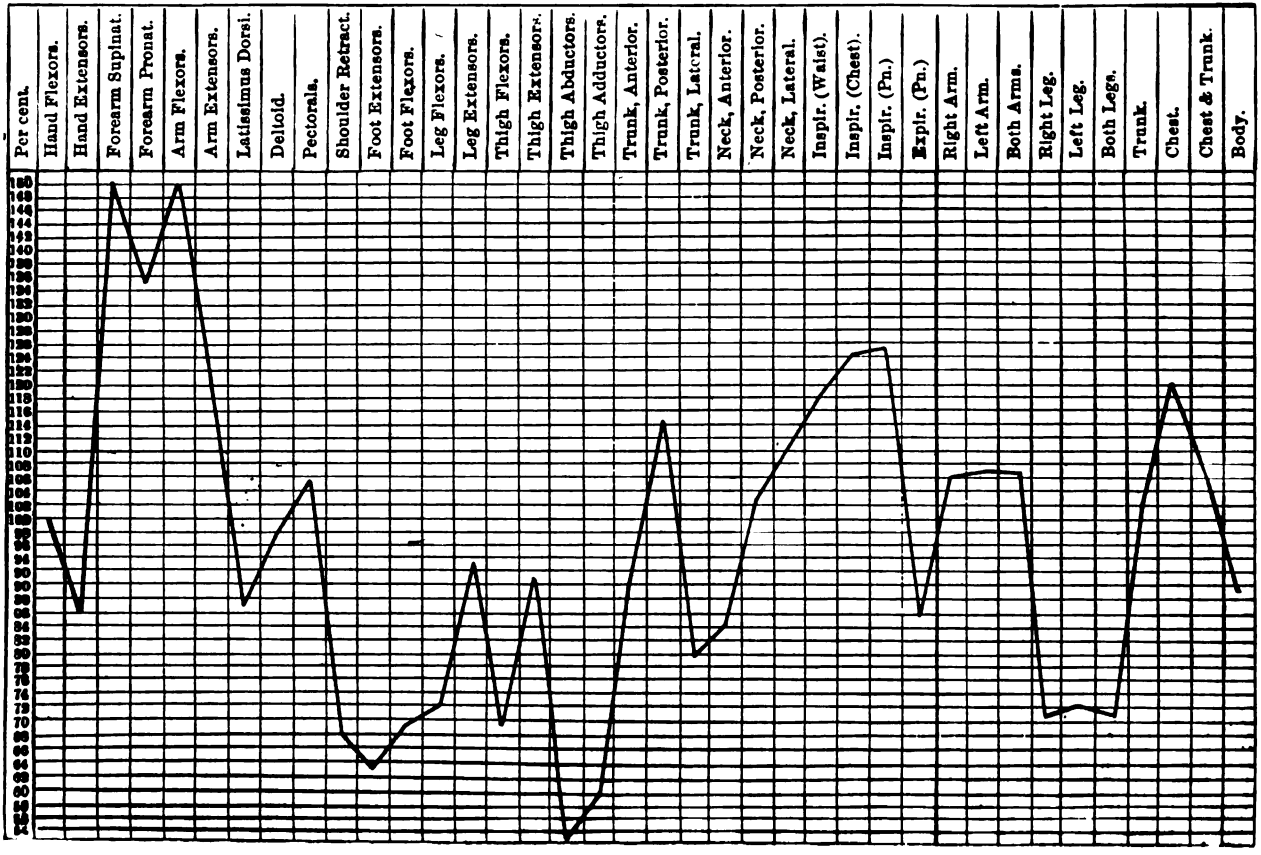
Many of the facts already noted, are still more clearly indicated in Graphic II.

The muscles which are relatively weakest in women are the forearm pronators and supinators, and the arm flexors. A very marked superiority in favor of men is also noticeable in the muscles concerned in respiration.

The inspiratory strength of the waist and that of the chest, both as measured with the dynamometer and with the manometer, or pneumatometer, is relatively much weaker in women than in men, the disparity being,—For waist inspiration, 1.18; chest inspiration, 1.24; and inspiration as measured by the pneumatometer, 1.25; or respectively, $2\frac{1}{8}$, $2\frac{1}{4}$, and $2\frac{1}{4}$ times greater strength for corresponding parts concerned in inspiration in man than in woman.

It is worthy of note, that the disparity in expiratory strength, on

GRAPHIC II.—GRAPHIC REPRESENTATION OF THE RELATION OF THE DIFFERENCE BETWEEN THE STRENGTH OF EACH GROUP OF MUSCLES IN THE AVERAGE MAN, AS COMPARED WITH THOSE OF THE AVERAGE WOMAN, TAKING THE STRENGTH OF THE MUSCLES IN WOMAN AS UNITY.



the other hand, as measured by the manometer, is not so great, being only 86 per cent., or 1⅛ times as great in man as in woman, the latter being unity. The explanation of this weakness of the inspiratory power in women is clearly to be found in the impediment to inspiration afforded by the conventional mode of dress among civilized nations, and the resulting deterioration in muscular structures. It is quite safe to predict that such a deficiency would not be found to exist in the case of savage women.

The obstacle existing in regard to inspiration does not exist in relation to expiration, since the constriction of the clothing would assist, rather than interfere with, expiration. If it be argued that the hindrance to inspiration is prevented by tight clothing and ought to act as a sort of gymnastics of the respiratory muscles, whereby they would acquire greater strength, it is only necessary to say in reply that one of the best established principles in relation to muscular development is the fact that long-continued and unrelenting opposition to muscular movement finally results in the tiring out and disabling of a muscle, rather than in its superior development. This is clearly seen in various forms of spinal curvature, as well as in other acquired deformities.

Another prominent point of weakness in women is found in the muscles of the back, which are in the average man 2½ times stronger than in the average woman. The pectoral muscles are also noticeably weak in women, which quite agrees with the weak inspiratory power of the chest previously referred to. Other interesting facts are more clearly shown in the graphic diagrams referred to, which, for want of space, cannot be given here. A few points may be briefly mentioned as follows:

Relation of Strength to Height and Weight in Men and Women.— Without going into all the relations of strength to height and weight which we have traced out, and which are based on the figures given in Table I, columns IV to VII, attention is called to the following as of special interest:

1. The strength of the average woman, in comparison with her weight, is less than two thirds that of the average man, as compared with his weight.
2. The strength of the average woman, in comparison with her height, is only four sevenths that of the average man.

3. The total strength of the average woman as compared with the total strength of the average man is .53. The weight of the average woman as compared with that of the average man is .86. The height of the average woman as compared with that of the average man is .92. It thus appears that the average woman while less than the average man in height, is still more inferior in weight, and presents a still higher degree of inferiority in strength. A comparative study of men and women between forty and fifty years of age would possibly show women to be somewhat less inferior in weight.

The full significance of these facts is recognized only when they are considered in connection with the law that weight increases with the cube of the height, whereas muscular strength increases only in the proportion of the square of the height. This principle gives the shorter individual an advantage over the taller, so that while, according to this law, we might expect to find women weaker than men, they should not be weaker than men in proportion to their height.

To make this point clearer, let us take an example: The average strength of 12 men, each 70 inches in height, was found to be 5,483 pounds. The average strength of 14 men, each 65 inches in height, was found to be 4,653 pounds. The calculated strength of the men, compared with that of the average man, is found to be exactly 5,425 pounds—only 58 pounds less than the actual strength observed.

Applying the same rule in a comparison of men and women, the following result was obtained: The average strength of 25 men having an average height of 69 inches was found to be 4,810 pounds; the average strength of 34 women, 64 inches in height, was found to be 2,652 pounds. The calculated strength of a woman 64 inches in height, obtained by the same rule, and taking the average strength of 25 men 69 inches in height as a basis, is 4,130 pounds. By this we see, that applying the ratio of the square of the height as a means of determining the strength for a person of given height, women fall short of the strength they should possess, the deficiency in the above case being 1,478 pounds. In other words, the strength of woman is only 64 per cent. of what it should be, as compared with man.

An actual comparison of men and women of the same height brought out the deficiency still more clearly. The average strength of 19 healthy women between the ages of 18 and 30 years, 65 inches in height, was found to be 2,660 pounds; the average strength of 14 healthy men of the same age and the same height, was found to be 4,653 pounds.

We find in these observations an interesting confirmation of the correctness of the principle that the strength of two persons of difent heights will be in direct ratio to the squares of their heights. It also appears that the actual facts, as observed by the comparison of the average strength of a large number of men and women of equal

heights, agree very closely with those shown by calculation, since the 19 women with an average strength of 2,660 pounds, should have had an average strength equal to that of the 14 men, whereas they fell short 1,993 pounds, or 43 per cent. According to this, the strength of the average woman is 57 per cent. that of the average man of the same height.

4. The strongest single group of muscles in the body in relation to body weight is the foot extensor group, which, in men, lifts 4.4 times the weight of the body, and in women, 3.1 times the weight of the body.

5. The following groups of muscles in the average man (the muscles of both sides being included) are capable of lifting the entire weight of the body or more: Hand flexors, forearm supinators, deltoid, latissimus dorsi, pectoral, shoulder retractors, foot flexors, foot extensors, leg flexors, leg extensors, thigh flexors, thigh extensors, thigh abductors, thigh adductors, trunk anterior, trunk posterior, trunk lateral, inspiration (waist), inspiration (chest).

6. In women the hand flexors, foot extensors, leg extensors, thigh flexors, thigh extensors, thigh abductors, thigh adductors, trunk posterior, and trunk lateral, are each able to sustain a weight equal to that of the body.

7. Those muscles which are able to lift a weight equal to that of the body in men but not in women, are the following: Forearm supinators, deltoid, latissimus dorsi, pectorals, shoulder retractors, foot flexors, leg flexors, trunk anterior, inspiration (waist), inspiration (chest).

8. It is interesting to note that the strength of each division of the body is more than sufficient to lift the entire body; even the smallest total found—that for the chest in woman—is able to lift 1¼ times the weight of the body. The highest total for a division of the body—that for the legs—indicates, in men, a strength 16 times that required to lift the body weight. The arms in men are able to lift 11 times the weight of the body, while the muscles of the chest and trunk combined are, in men, capable of lifting 10 times the body weight.

9. The foot extensors are, in men, a little less than fifty per cent. stronger than in women, when compared with the body weight, although the flexors are but a little more than one third stronger in men than in women.

10. The strength of the inspiratory muscles as compared with the body weight in men, is nearly twice that of women.

11. The lateral muscles of the neck have a strength, in relation to the weight of the body, nearly double that of the same muscles in women, a fact which is readily explained by the greater size of the head in men.

12. The back muscles are stronger in men, in proportion to total strength, doubtless in consequence of the heavier arms, shoulders, and head which these muscles are required to sustain.

Relation of Strength to Height.—In this relation, special interest attaches to the following figures, which express the number of pounds lifted for each inch of height:

1. For men: arms, 22.5; legs, 33.4; trunk, 15.4; chest, 5.4; entire body, 76.7.

For women: arms, 11.7; legs, 21; trunk, 8.2; chest, 2.6; entire body, 43.6.

2. The strongest group of muscles in the body, in relation to the height, are the foot extensors, which are able to lift a little more than 9 pounds for each inch in height, in men, and 5.78 pounds for each inch in height, in women.

TABLE III.

RELATIVE STRENGTH OF OPPOSING MUSCULAR GROUPS IN MEN AND WOMEN.

(The Group first mentioned is taken as unity.)

MUSCULAR GROUPS.	MEN.	WOMEN.
Hand—Flexors, Extensors	4.61	4.31
Forearm—Supinators, Pronators	1.07	1.00
Arm—Flexors, Extensors	.94	.91
Latissimus Dorsi—Deltoid	1.32	1.39
Pectorals—Shoulder Retractors	1.31	1.07
Foot—Extensors, Flexors	4.23	4.09
Leg—Flexors, Extensors	.84	.94
Thigh—Flexors, Extensors	.92	1.03
Thigh—Abductors, Adductors	.91	.95
Trunk—Anterior, Posterior	.37	.42
Trunk—Right Lateral, Left Lateral	1.01	1.03
Neck—Anterior, Posterior	.47	.51
Neck—Right Lateral, Left Lateral	1.00	1.00
Inspiration—Expiration	.35	.29
Arms—Flexors, Extensors	1.47	1.41
Legs—Flexors, Extensors	1.41	1.50
Trunk—Flexors, Extensors	.58	.63
Entire Body—Flexors, Extensors	1.18	1.22

Relative Strength of Flexor and Extensor Muscles.—(Table III.) It is evident that in order that bodily movements should be well

balanced, the opposing muscles must be endowed with proportionate strength.

Inspection of the table affords many suggestive comparisons.

The force of inspiration is but one third that of expiration, as shown by the pneumatometer; but it should be remembered that the expiratory muscles have the assistance of the elasticity of the chest walls and of the lungs, which oppose inspiration, but aid expiration.

The facts shown in the table are interesting from a physiological standpoint, though the cause has not been fully determined. It is probable, however, that it is to be found in the greater amount of work which, as a rule, is imposed upon the flexors.

In comparing the figures for men and women, it is observed that they run remarkably close together.

The Strength of Each Group of Muscles, and of Each Division of the Body, as Compared with the Whole Body.—(Table I, columns VIII and IX.) The most prominent point brought out by this comparison is the fact that the strength of even the strongest group of muscles in the body—the foot extensors, the muscles of the calf—is small when compared with the total for the entire body.

The Strength of Each Group of Muscles (right and left) as Compared with the Strength of the Corresponding Division.—(Table I, columns X and XI.)

1. The strength of the foot extensors is a little more than one fourth the totals for the legs.
2. The strength of the muscles of the back is more than one third the strength of the entire trunk, exclusive of the chest.
3. The relative strength is found to be greater, in women, in the hand flexors, the hand extensors, the deltoid, the latissimus dorsi, the pectorals, and the shoulder retractors, as compared with the total for the arms. The foot extensors, the foot flexors, the thigh flexors, and the thigh abductors and adductors are also stronger in relation to the total for the legs, than in men. The anterior and lateral muscles of the trunk show a similar superiority; also the anterior neck muscles. It should be remembered, however, that in the total strength of the trunk muscles, the average woman is much inferior to the average man.

Strength of the Muscles of the Left Side of the Body as Compared with those of the Right Side.—(Table I, columns XII and XIII.) In a symmetrically developed man, the muscles of the right and left sides should be found of equal strength, but the unequal training of the average man gives the right side of the body an advantage in the case of nearly every group.

1. In only three instances do the muscles of the left side exceed those of the right side, in the average man, viz., the thigh flexors, thigh extensors, and thigh adductors. Why these thigh muscles should, on the average, be stronger upon the left side is a question which I have not been able to settle. I have, however, for many years, made this observation, and it is clearly shown in the average measurements made in more than one thousand men. It has occurred to me that, while we are right-handed, we have a tendency to left-leggedness, and my observations certainly seem to justify this idea, although the totals for the right and left leg are found to be exactly the same, a marked deficiency of the flexors and extensors of the left leg, as compared with the right, serving to counterbalance the excessive development of the thigh flexors, extensors, and adductors.

2. In the average woman, as in the average man, the left side is ahead of the right at three points. Curiously, however, none of these points coincide with the corresponding points in men. The points of left-side superiority in women are found in the shoulder retractors, foot flexors, and leg extensors.

3. In women, there is a greater degree of asymmetry, as regards bilateral development, than in men. The total strength of the left side of the body, in men, is 99 per cent. that of the right side, so that the two sides of the body are very nearly balanced. In women, the total strength of the left side, as compared with the right, is a little less, or 98.6 per cent. This is what we should expect from the inferiority of woman, in relation to man, in muscular development.

Comparison of the Muscular Strength of Tall Men with that of Short Men.—(Table I, columns XIV to XVI.) The average heights of the groups compared were respectively: For tall men (15), 71.5 inches; for short men (39), 64 inches. No height in either group varied from the average more than one half inch.

In a comparative study of tall men and short men, it was found that tall men are at nearly every point stronger than short men. The total strength-capacity for a short man was found to be 90 per

cent. that of a tall man. At four points only are short men superior to tall men; namely, the lateral and posterior muscles of the neck, the trunk laterals, and the deltoid.

The reasons for this difference are interesting. As has long been known, the difference between the height of tall men and short men is chiefly due to the difference in the length of the legs. The arms of the short man are longer in proportion to his height than are the arms of the tall man. In view of this fact, we should expect to find the relative strength of the arms in short men greater than that of the legs. In the case of the muscles of the trunk and neck, the short man has an advantage over the tall man, in that his muscles have a better leverage. Both the neck and the trunk are shorter in the short man, thus giving an anatomical advantage which is apparent in the records made by the dynamometer.

Comparison of the Muscular Strength of Tall Women with that of Short Women.—(Table I, columns XVII to XIX.) The average heights of the two groups compared were respectively: For tall women (64), 66 inches; short women (88), 61 inches. No height in either group varied more than one half inch from the average.

In the comparison of tall women and short women, it is found that short women, while showing a total average strength of only 92 per cent. that of tall women, are ahead at three points, viz., the pectorals, posterior trunk muscles, and the muscles of inspiration (waist).

The superiority of the pectorals is a characteristic which is not shown in short men, hence is probably accidental. The greater strength of the muscles of the trunk, and also of the waist-expanding muscles, is probably due to the anatomical advantage referred to in the case of short men.

It is interesting to notice that short women as well as short men, show a superiority at this point over taller persons of the same sex. I think the fact is more than a coincidence, and is confirmatory of the explanation above given.

Comparison of the Muscular Strength in Men and Women of Equal Height.—(Table I, columns XX and XII.) In the comparison of 45 men and 45 women of equal height, the average height being 65

inches, and no individual varying more than an inch from the average height, it was found that the average woman is slightly less inferior to the average man of the same height than is the average woman when compared with the average man considered without reference to height.

The figures are 57 per cent. for the woman of equal height as compared with 53 per cent. for the average woman. Two or three points are especially worthy of notice. The thigh adductors and thigh flexors of the woman of equal height have a relative strength slightly less than that of the average woman, the figures being respectively 60 and 62 for the adductors, and 52 and 59 for the thigh flexors.

Comparative and Relative Strength of Homologous Muscles in Men and Women.—(Table IV.) In this comparison the flexors of the hand are compared with the extensors of the foot, and *vice versa;* the deltoid with the thigh abductors; and the latissimus dorsi with the thigh adductors.

TABLE IV.

RELATIVE STRENGTH OF HOMOLOGOUS GROUPS OF MUSCLES IN MEN AND WOMEN.

MUSCULAR GROUPS.	MEN.	WOMEN.
Hand Flexors, Foot Extensors	.41	.34
Hand Extensors, Foot Flexors	.37	.33
Arm Flexors, Leg Flexors	.60	.41
Arm Extensors, Leg Extensors	.54	.43
Deltoid, Thigh Abductors	.68	.53
Latissimus Dorsi, Thigh Adductors	.81	.70
Forearms, Legs	.76	.59
Arms and Shoulders, Thighs and Hips	.63	.54
Total Arms, Total Legs	.67	.56

This table presents many interesting facts respecting the relative strength of homologous muscles.

The figures shown in Table I may be for the most part considered as coefficients, or indices, of vital conditions. My idea in working out the table has been to furnish a basis whereby the relations of the

individual as a whole, or of any group of muscles, to the normal standard might be more readily determined than by the present method of tape-line measurements. I have in hand the preparation of a chart in which these coefficients shall be determined for each height independently, using for this purpose the data which I have collected in the strength measurements of about 3,000 men and women. Some of the coefficients shown are of greater value than others. Those to which I would especially call attention (these paragraphs were written since the paper was read, the addition being suggested by the interesting and valuable paper by Dr. Enebuske, relating to vital indices. No new matter is added to the paper, my purpose being simply to call attention to this one mode of utilizing the data furnished in Table I) are the following:

1. *The Strength-Weight Coefficient.* This is shown for both men and women, and for each important group of muscles, in columns IV and V of Table I. To obtain this coefficient by testing the strength of a single group of muscles is manifestly unfair, and of no value except with reference to a special form of exercise, such as climbing or other exercises in which the weight of the body must be lifted by the arms. If the aim is to obtain information respecting muscular symmetry, it is evident that the total strength of the arms must be considered rather than simply the strength of either the flexor or the extensor group alone, if the arms are to be considered. But a matter of very much more importance is the strength-weight coefficient of the entire body, which is shown to be for man, 37.34, and for woman, 23.42 (Table I). These figures, of course, relate to the average mean man.

2. *Respiratory-Weight Coefficient.* This is obtained by multiplying the lung capacity in litres by the respiratory strength in kilograms, and dividing the result by the weight in kilograms. This gives the coefficient of the average mean for man, 11.9; for woman, 4. In other words, man has a respiratory-weight coefficient nearly three times that of woman.

3. *Strength-Height Coefficient.* This is obtained by dividing the total strength in kilograms by the total height in millimeters. This is shown for each group of muscles and the entire body (expressed in pounds and inches), for both men and women, in columns VI and VII, of Table I. The same relation for kilograms and millimeters may be ascertained by simply dividing the figures given by 55. This gives the total strength-height coefficient of the average mean man, 1.4, that is, the average mean man is capable of lifting 1.4 kilograms for each millimeter in height; for women, .8, that is, the

average mean woman is able to lift .8 kilograms for each millimeter in height.

4. *Respiratory-Height Coefficient.* This is obtained by multiplying the lung capacity in litres by the respiratory strength in kilograms, and dividing by the height in millimeters, giving for the average mean man a coefficient of .44, and for woman, .13, from which it appears that the respiratory-height coefficient in woman is a little less than one third that of man.

5. *Coefficient of Physical Efficiency.* This coefficient is obtained by multiplying together the strength-height coefficient and the respiratory-weight coefficient, giving for man a physical efficiency coefficient of 444.4; for woman, 93.7, from which it appears that the coefficient of physical efficiency is for man nearly five times that for woman.

6. *Coefficient of Vital Development.* This is obtained by dividing the respiratory-height coefficient by the strength-height coefficient, giving for the average mean man .31, and for woman .16; that is, woman has a trifle more than half as good a vital development as man, considering the breathing capacity in relation to the bony and muscular development. Or, in other words, woman has but about half the breathing capacity of man in proportion to the amount of work which her bones and muscles fit her to perform.

Numerous practical deductions and applications which can be made of these interesting facts at once suggest themselves and I believe will well repay careful consideration by those who are students of this subject. The practical utility of coefficients of this sort can be made much greater by the preparation of a chart in which individuals of the same height are grouped together, the coefficients being multiplied by such factors as to place them upon the basis of 100 for the average mean individual. By this means it will be possible to show at a glance the exact relation of an individual, man or woman, to other persons of the same class.

The results which have been presented in this paper, it is hoped, will constitute the beginning of a line of study which will prove both interesting and profitable. I do not present these results as being in any sense exhaustive, although they have occupied many months of painstaking work on the part of myself and expert accountants whom I have employed in making the necessary computations. If they shall serve to stimulate further inquiry in the same line, and if they are accounted worthy of recognition by this body of experts, I shall feel amply repaid for my labor. Indeed, I may justly say that I feel al-

ready amply compensated by the assistance which I have derived from the information obtained in dealing with the various classes of physically infirm men and women who have come under my professional care. I sincerely hope that some enthusiast in anthropometry who has more leisure for the pursuit of this very fascinating study may take up this line of investigation and carry it still further. I feel sure that the subject may be properly regarded as a mine of unexplored wealth in the aid which it will afford to scientific physical training.

Dr. Seaver.—I take a great deal of pleasure in saying that I have not only tested this instrument myself but have called in the expert in mechanical engineering at Yale to examine it, and I feel confident that it is a reliable mechanical instrument. When we all come to use it we can compare our results taken at Yale and at Harvard, and until we do we cannot do so.

Dr. Sargent.—I have listened to Dr. Kellogg's paper with a great deal of interest. I think he has made a very valuable contribution to our subject. I realize, as Dr. Seaver has mentioned, that our hand dynamometer is not properly constructed. My experience would lead me to differ with him, however, in regard to the use of a spring dynamometer, if the instrument is properly made in the first place. While this machine is an admirable one, I hardly think it would be practicable for universal use, on account of its cost and the number of tests recommended.

Dr. Arnold.—I cannot help admiring the mechanical principles on which this apparatus is built. An apparatus is good, I should think, if it is constructed according to the principle of leverage, which can be made with much greater accuracy than springs. But the ways of making tests might differ greatly, and might give rise to errors where there is no provision to eliminate the action of muscles not included in the test. If we wish to make a test of the flexors of the arm, the muscles which fixate the shoulder girdle, on which the upper arm is moved, have to be set so as to give a point of resistance. Now this setting is practically done only by trunk muscles. Who will tell us when the movement is not possible, whether it is because the flexors of the arm are weak, or because those fixating muscles are too weak? I should say a method is needed in order to make the test accurate, by which such errors are eliminated. Other-

wise I do not think this apparatus would give comparable results if employed in different ways, by different men, in different places.

Dr. Foster.—At Bryn Mawr we are using spring dynamometers. I had mine tested a few days ago. At some points it registered too high, and at others too low. It seemed to me that the error might be corrected by graduating the scale to the spring, instead of graduating the spring to the scale. The scale is made with *even* degrees, while the movement of the index is uneven.

Mr. Coop.—This matter of springs as a means of testing resistance has been of a great deal of interest to me from a manufacturer's standpoint. I have absolute confidence in a well-made spring being able to record exactly and repeatedly. The instrument used in testing steam engines, known as the "indicator," probably has more value based on its exactness than any other one instrument. It depends on a spring less than three inches long and an inch in diameter,—an error of a fraction of an ounce in that spring means hundreds and thousands of dollars. I would call attention to the fact that engineers years ago abandoned the mercurial column for a spring in the construction of steam gauges, the fact being that momentum and other factors vitiated its accuracy. I have hope yet of getting springs that will be uniform in strength. The point to which Dr. Foster has called attention has led us to follow the practice of graduating each spring. We graduated a dial in one series of springs, electrotyped that dial, and tried to make our springs meet it. We could not do it, and gave it up. We are working in that line, and hope to reach results before long.

Dr. Kellogg.—I want to say that I am not at all interested in the manufacture of this dynamometer. It has been made so far as a sort of missionary enterprise in anthropometry. I have listened with much interest to the remarks made by the gentlemen with reference to the accuracy of my instrument; like any other instrument of precision, it must be used intelligently. I want to say a word also about spring dynamometers. I doubt not that what the gentleman says is true. The difficulty is that they do not stay reliable. A number of years ago I procured an excellent set of dynamometers. At one time I tested them and found them very accurate, but to-day they are absolutely worthless. I found they ceased to be accurate long ago. They will have to be graduated entirely anew to make

them reliable. I think it is necessary to graduate a spring dynamometer once in two or three years to keep it right. The gentleman remarked that the mercurial column was abandoned long ago. It is in use in the physiological laboratory; whenever very nice measurements are necessary, it is in constant requisition. I do not know of any physiological laboratory that does not use it for this purpose. The great objection that I find to spring dynamometers is not their unreliability, but that they are adapted to only a very small number of muscles. The few tests that can be made represent such a small part of the whole muscular system that one does not have much of an idea of the individual from the tests he can make. I found the average strong man able to lift ten thousand pounds. When you bring this down to a few hundred, as in testing a few groups of muscles, you have a very small representation indeed of the total power of the muscular system, and no foundation upon which to base an index or coefficient.

THE HYGIENE OF BODILY CULTURE.

BY EDWARD MORTON SCHAEFFER, M. D., OF BALTIMORE.

My topic was, in one sense, assigned me, for it grew out of a conversation with Dr. Seaver on the importance of emphasizing before our esteemed lay membership what I may call the accessories or context of physical training. Being prevented by illness from attending the Yale meeting of the Association, I have since found something of what I wished to say in the remarks of Pres. Stanley Hall and Dr. Randolph Faries on that occasion.

Dr. Hall says,—"We ought always to give only one subject precedence to physical training, as it is generally understood, and that is the matter of regimen. We are very prone to forget that there is a nutritive and trophic background to every function and activity of life. The very first thing of all which gives us justification for intellectual and for athletic training, I believe, is a good digestion; this must be put in the foreground, and other things subordinated as means until it is secured."

What constitutes plain food, an abundance of sleep, a proper

system of bathing, and a wholesome and unconstraining regimen? There is no question, according to my experience, which is so little studied in medical schools or so variously interpreted, if seriously considered at all, among the intelligent community we serve.

The personal equation almost unfits the average doctor or instructor for advising in these matters. Sanitariums, under efficient medical management, have done more to determine these every-day questions of health than has our profession as a body. No teacher of physical training can afford to be wholly ignorant of such subjects as the science of nutrition or applied dietetics, the sanitary or therapeutic uses of hot and cold water, and the principles of correct dress, be it a question of material or of adjustment.

The subject of water has never been a very popular one since the flood, except among the Greeks and Romans, and, perhaps, the Japanese. From the difficulty with which reformers prevail on our cities to erect public baths for the great unwashed multitudes, we might well imagine that many a Svengali, with his mirth at the Englishman's ablutions and his abhorrence of *aqua pura*, had risen to a seat in our common councils.

Baths have many distinct purposes, which are often confounded and neutralized in practice. They are invaluable as tonics and stimulants, taken hot or cold as indicated; as sedatives, eliminants, as well as cleansing agencies. A few people, mostly women, addicted to tub-baths, wash and soak their very vitality away from an excess of zeal. The majority of persons, however, bathe too infrequently (mostly Saturday nights, when hot water is apt to be scarce). In health institutions the baths are a luxury of life. They should be so given or taken, in the home circle, as to be welcomed rather than dreaded or postponed. Any one can, by spending a few days at some well-conducted sanitarium, learn the details of these matters, or our committee on bibliography might recommend certain books which cover the ground, less satisfactorily.

The problem of nutrition and the knowledge of what it pays to eat (we all know what it costs, though our food may be neither digestible nor palatable) is of prime importance to every instructor and household provider. It will not make you hypochrondriac to compare your dietetic instincts and habits with some of the useful food and nutrition charts and tables now published, and to be had

for the asking on application to the Agricultural Department at Washington.

I hope to live long enough to see the subject of woman's dress of sufficient interest to her admirers to have the latter educate their own taste and common-sense up to the point of a healthy and artistic standard, but I do not want to be obliged to do so.

I used to think that doctors held a powerful lever with which to burst all confining fetters and curtail unnecessary impedimenta of costume, but I have outgrown that idea. Possibly the "Harvard Venus," erected by Dr. Sargent at the World's Fair, was an effective argument for discarding the corset and all modes of dress that restrict the free and full development of a comely figure. I know that our Association is doing a splendid work in thus correcting the inartistic absurdities of fashionable bodily limitation. A clever artist and novelist has at last aroused enthusiasm for bodily culture and freedom by getting his heroine and his fair readers "worked up" on both feet, so to speak, but the honor of the *coup de grace* is reserved, in my judgment, for the bicycle, which is destined by its own graceful and healthful revolutions to complete the physical emancipation of woman.

If the barber's pole with its red and white stripes reminds us of the time when doctors were bleeders and emptied folk of pretty much all that they possessed, the world will some day regard the corset as the crest of the gynecologist's patronage, for this figure- and health-wrecking contrivance indicates the candidate for his services as unmistakably as it does the devotee of fashion and deformity.

In the matter of costume, no one desires to see the woman "ape the man," as it is expressed, but in assuming the divided skirt, or even the bloomer, for purposes of exercise or ease of locomotion, it should be acknowledged that women are simply recovering stolen property, for the women of the East invented the trousers, and the conquering Persians thought it such a good idea that they took them from her, giving her a sound lecture on her proper sphere, and presenting her the pattern of their discarded skirts in exchange. It has always seemed to me that the reason some men insist so much upon woman's sphere (of inactivity and dependency) is due to a propensity to dodge dealing with her on the square, and to keep her

revolving in a petty circle of which they are the radius. Man's sphere is said to be base-ball.

Now every good remedy is potent for evil if abused, but I think it may be safely said that, theoretically, the wheel is woman's ideal deliverer from the physical follies and neglect induced or reinforced by the constricting dress of her sex. Certainly it is the most perfect and attractive all-round, fresh-air exercise she can take, and the 70,000 fair riders in the United States will join their testimony. Its utility has been studied more abroad than at home, and it is becoming a part of our armamentarium for the cure of chronic disease.

"The recovery of health," says Dr. Kellogg, "by an invalid is just as much a matter of development as is the growth of a tree, and a large share of the treatment ordinarily employed is mere temporizing. There is an enormous amount of unnecessary invalidism and disease which could be prevented or cured by proper physical development and hygiene. A lack of vigorous muscular development is one of the fundamental causes of a great share of the special ailments of woman, and a substantial cure cannot be effected by any other means than by the development of the muscular system and the building up of a good physique."

One of the best articles for popular reading on this subject, "Woman and the Wheel," is by Dr. Champonnière, of the Hospital St. Louis, Paris. He enters into many details as to regimen, costume, necessary precautions, etc.

As our membership is so largely composed of ladies, and as there is still so much prejudice to be combated outside, I have thought it expedient to pay this tribute to the wheel, as an adjunct to our sanatory apparatus.

DISCUSSION.

Dr. Savage.—One feature of the subject is the dietetic phase of physical culture. It makes little difference what exercise we prescribe, or what tests are taken, if the matter of nutrition is not understood and given its proper attention. We need to direct more attention and discussion to physiological chemistry. The matter of nutrition is not sufficiently taken into consideration in prescribing, and a great deal of our unfruitful work is due to lack of apprecia-

tion of the nutrition of the person that we are laboring for. I think at our next gathering that discussion ought to have its full share of time. It has far more important results than anthropometry.

Miss ——.—I would like to ask a question in regard to bicycle riding. It is recommended to us as such a very healthful exercise; and yet, as I watch the people who ride about the streets, I find that the great majority of them are in a very bad position.

Dr. Seaver.—Those are mostly men, are n't they?

Miss ——.—Men and women too, though it is more evident in men. I am often asked, "Is it a good exercise?" and my reply has always been, "Yes, if you take it correctly." But the tendency, it seems to me, is toward wrong positions, such as necessarily overcome all the good effects. How are we to overcome that? A great many people seem to think that if they ride, they must of necessity fall into bad habits. Can it not be avoided?

Dr. Seaver.—The way to remove it would be by setting everybody a good example ourselves. I try to set one. Dr. Kellogg, have you ever seen a woman on a bicycle?

Dr. Kellogg.—I believe the bicycle is one of the most health-promoting devices we have. We use the bicycle at the Battle Creek Sanitarium regularly, as a therapeutic means of great value. My experience in riding is that the entire body is exercised, with the exception of the arms. If one can ride without the handle bars, it is a most splendid exercise for the trunk. One cannot possibly ride in a stooped and round-shouldered position without injury. One cannot get into that miserable attitude when riding without the handle bar, but is obliged to sit up in a good, Swedish sitting position. I consider the use of the bicycle to be ahead of any other single all-around exercise that we have. If one gets out of breath, he may very soon correct the excessive action of the heart by slow leg movements. It is exactly what we do in executing a Swedish day's order.

Dr. Seaver.—I would like to have Dr. Kellogg say a word regarding the assertion that it affects the kidneys unfavorably.

Dr. Kellogg.—I think that is certainly a fallacy. Chronic disease of the kidneys is most frequently due to the excessive accumulation of tissue poisons within the body. Exercise promotes purity of the blood. Bouchard has shown that the co-efficient of urinary

toxicity is lessened to the extent of 50 per cent. by exercise, through the promotion of the oxidation processes in the tissues, by muscular activity. I have repeated his experiments, and have been able to confirm his results. This indicates that the bicycle, as well as other means of exercise, promotes kidney health and activity. There is no reason why the bicycle, any more than any other means of exercise, should be forbidden on the grounds suggested. In cases of acute nephritis, however, and in advanced cases of chronic albuminuria, bicycle riding, as well as all other very vigorous exercise, should be forbidden, for the reason that such exercise may suddenly throw into the blood such a quantity of fatigue poisons as to overwhelm the kidneys and aggravate the disease.

Dr. Fitz.—I am very much interested in what has been said about the stooping position of the body. All sorts of ills have been attributed to it. It seems to me it is not so bad as has been thought. Personally, I believe it is better to sit up straight, but, in a way, it is perfectly possible to lean forward, relieving the chest from the weight of the arms and shoulders, and so favor respiration; because, if the arms are supported on the handle bar and a part of the weight of the body is thus supported, it certainly takes the weight off the chest and aids the movement of the ribs, and it need not necessarily produce any increased kyphosis. The bad effect on respiration would be apparent if it existed, and those who are in the habit of riding fast would be forced to sit up straight.

Dr. Seeley.—It seems to me that Dr. Fitz did not give quite the whole story. There are two ways of putting weight on the arms,—one in which the body is bent entirely at the hips, as at races, where they put very much weight on the shoulders without bending their backs. But people try to imitate racers, and sometimes make the bend in the dorsal region, which, it seems to me, is very different. The advantage in "scorching" is that of lessened air resistance. Of course it is not nearly so great when met by the head as when sitting up; for that reason respiration may be helped very much. But I think we ought to insist on the bend being made at the hip.

Miss ——.—I would like to ask if stooping does not interfere with respiration in riding a bicycle?

Dr. Seeley.—I cannot see that it would do any special harm.

I can see that long handle-bars, the ends being brought near together, might interfere to some extent; but still I do n't know that bicycle riders have any difficulty in respiration. They have better wind than some of us who sit up straight.

DR. SCHAEFFER.—It is well known that the rule about putting your shoulder to the wheel does not apply to bicycle riding, nor the injunction to make both ends meet. I regard the wheel as more likely to settle the questions about woman's sphere than any other agency. Women are better adapted to the wheel than men, because the distinctive feature in bicycling is keeping the equilibrium. Being more supple than men, they take naturally to balancing exercises. I rarely see them in an ungraceful attitude on the wheel, though the problem of costume is vexing at times to both rider and observers.

THE PHYSICAL PROCESSES INVOLVED IN THE NUTRITION OF MUSCLE, AS INFLUENCED BY ALTERNATING ACTIVITY AND REST.

BY JACOB BOLIN, OF NEW YORK CITY.

In a broad sense nutrition means the exchange of material between the nourished tissue and the medium surrounding it. It may therefore be dissolved into two components, assimilation and excretion, —the simultaneous increase or decrease of which causes improvement or deterioration in the regeneration of the tissue, i. e., an improved or deteriorated nutrition. We are well aware that the nutrition of an organ is enhanced by activity, within certain limits, and that it decreases if the activity rises above or falls below these limits. So far as I know, however, we have been given no detailed explanation of the immediate causes of this fact. It does not, for instance, suffice to say that the cause is to be found in the increased local circulation which results from activity; at least, if we mean with this expression, as is generally the case, the intravascular flow. First, because this is always made more rapid by activity, and we should therefore expect the nutrition to improve *ad infinitum* under the influence of activity, while rest would always be injurious to the

tissue from a nutritive standpoint, both of which conclusions we know are erroneous. And secondly, we have only approached the real question one small step by such a statement, as it would still rest with us to find the answer to the inquiry, Why does the exchange between the tissue properly speaking, and the blood within the vessels, increase with the increase in the blood current?

It will be my endeavor in this paper to bring the matter, so far as the muscles are concerned, down to some elementary facts deduced from physics.

The histology of muscle shows us a bundle of contractile, protoplasmic fibres, each surrounded by a thin membrane, the sarcolemma, resting in a bed of connective tissue, carrying the blood and lymph vessels and leaving between the fibres certain intercellular spaces filled with a fluid, which we may call the intercellular fluid. These spaces are continuous with the lymphatics and are considered as their origin.

If we follow a particle of nutritive material on its way from the arterial blood until it has been stowed away in the muscle fibre, we see that it must first pass through the capillary wall, which must occur either through osmosis or filtration. Thereafter it must make its way through the intercellular fluid from the immediate vicinity of the capillary wall to that of the sarcolemma; either because of simple diffusion or because of currents which may be set up in this fluid by pressure,—by its agitation. Then by osmosis or filtration it shall pass the sarcolemma, and finally on account of diffusion or pressure currents be swept into the internal part of the protoplasm.

With the exception of those particles which may happen to find their way from the intercellular fluid into the lymphatics at their origin, or through their stomata, all excretory matter from the muscle fibre must be eliminated by exactly the same processes in opposite order.

The nutrition—i. e., the assimilation and excretion—of a muscle depends therefore on the combined effects of these four physical processes:

1. *Osmosis* by which we mean the passing of a substance through a membrane independent of pressure.
2. *Filtration*, which is a corresponding passing of a substance through a membrane depending on pressure.

3. *Diffusion*, or the mixing of fluids in immediate contact with each other independent of pressure.

4. The mixing of two fluids in immediate contact with each other dependent on pressure, which sets up agitation-currents in them.

An exchange between the muscle and the blood goes on, as we know, at all times, consequently in rest as well as in activity. That osmosis and diffusion play parts in this exchange follows necessarily from the fact that the fibre and the blood contain miscible constituents of different chemical nature. But the change of intravascular pressure which results from the pump-like action of the heart and arteries must also necessarily cause a filtration from the arterial capillaries into the intercellular fluid with each increase of pressure, and a similar filtration from this fluid into the venous capillaries and the lymphatics with each decrease of pressure, if we acknowledge a filtration to be at all possible. The change of pressure to which the intercellular fluid thus would be subjected, would then again cause similar filtration processes through the sarcolemma. It is also evident that this alternate increase and decrease of pressure must necessarily set up agitation-currents within the intercellular fluid and secondarily within the protoplasm.

Before going further, it would therefore be desirable for us to decide whether a filtration process can be considered possible, as the opinions of physiologists surely have been divided upon that point.

First of all, it has seemed to me that the supposition in favor of filtration has been strongly supported by the analogous procedure in the digestive organs, where the pump-like actions of the villi have been long recognized, while no better reasons have been given against it than the purely negative one that it has not been shown to occur. And even this appears of late to have been strongly shaken, especially through the experiments of Cohnstein as published in *Pflüger's Archiv*. I therefore believe that filtration plays as important a rôle in the nutrition of muscle as osmosis and diffusion.

But how are we to understand the influence which alternating contractions, relaxations, and rest have upon the rapidity of these processes?

When a muscle is stimulated, certain chemical changes are set going in the fibre, by which heat is generated, and the equilibrium is

disturbed in such a way that the molecules at the ends of the fibre move in a direction towards the equator, the fibre shortens and thickens, while the supplying artery by an automatic arrangement is dilated.

The disturbance of equilibrium within the fibre means a decrease in pressure at the equatorial region of the fibre, and currents moving in that direction. An agitation thus occurs which favors the passing of substances from the ends towards the centre, until equilibrium is restored. During the relaxation currents in an opposite direction are started in the same way.

But an agitation within the fluid or half-fluid mass of the fibre, must also be noticed outside. From the histological formation of the muscle, it follows that the fibre must necessarily during its contraction encroach upon the intercellular spaces at its equatorial region, while withdrawing from them at its poles, and currents must therefore from necessity be started in the fluid filling these spaces, which correspond to similar currents in opposite direction during the relaxation process,—an increased agitation occurs in the intercellular fluid.

The difference of pressure which is the cause of these currents both within the fibre and outside it is, however, not limited by the membranes, the sarcolemma, and the vascular walls, but must make itself felt through them, thus increasing the exchange of material due to filtration. At the moment just preceding the contraction, when the pressure is consequently at its height at the poles and lowest at the equator, an increased filtration through the sarcolemma in the direction from the fibre to the intercellular space must therefore take place at the poles of the fibre, while the inward filtration current must be increased at the equator. Just previous to the relaxation, when the pressure has been changed, filtration is assisted in the opposite direction. That which is true with regard to the sarcolemma and filtration through it, is equally true with regard to the capillary wall.

We may now pass to a consideration of the chemical changes in the fibre preceding the contraction and their possible influence upon the exchange. The exact nature of these changes is unknown to us, but it may be safe to state that by them the alkaline or neutral reaction of the fibre is changed into a neutral or acid one, and that

colloids are broken up into crystalloids. Now we know definitely that osmosis and diffusion take place more rapidly in acid than in alkaline media from which it immediately follows that other conditions being equal, the diffusion within the protoplasm, and the osmosis through the sarcolemma must be accelerated, and that consequently the same processes within the intercellular fluid and through the capillary walls must also be improved.

The change of colloids into crystalloids is also of importance with regard to the exchange. The colloids do not diffuse or pass through a membrane except in rare cases, and even then with difficulty, while the crystalloids easily diffuse and pass a membrane by osmosis. Furthermore, on account of their large molecules, the colloids filtrate only with difficulty, while the crystalloids do so more or less easily because of their simpler composition.

Again, diffusion and osmosis occur more rapidly if the fluid which thus passes is more concentrated. Hence, as the contraction increases the amount of waste material within the fibre and the solution in the fibre consequently becomes more saturated, their excretion must become hastened.

The increase of temperature which results from these changes gives also a condition favorable to increased diffusion, osmosis, and mixture through agitation, though it is inimical to a rapid filtration.

The dilatation of the supplying artery and the consequent area of the arterial capillaries gives increased surface through which the passing of nutritive material from the blood into the intercellular fluid may take place.

In review, therefore, we may say that a single contraction and its complement, the relaxation, favor all the physical processes, by which the exchange in both directions between the muscle and the blood takes place, with the possible exception of the filtration which may be slightly retarded because of the higher temperature.

If the conditions now remained exactly equal, a second contraction would have the same effect, and thus assimilation and excretion go on to improve in the same ratio as the work increases, and therefore the muscle must be able to carry on its function *ad infinitum* if only the blood carry sufficient nutritive matter to supply material for the energy-transformation, and the excretory organs eliminate the refuse from the venous blood. But it is well known this is not

the case. The muscle seems to need a rest aside from that represented by the relaxation process, else it will become exhausted and waste away. We must therefore seek an explanation of this fact.

What we have said above shows that we may conclude *á priori* that more waste matter must leave the muscle during its activity than during its state of rest, a conclusion which is also borne out by *ex posteriori* observations. But we have not shown, and I believe cannot show, that a greater percentage of the waste matters created leaves the fibre during activity than during rest. We know that more of these materials can pass the sarcolemma in the unit of time than really does so during rest, because during activity such is the case. If we therefore with A denote the amount created during the unit of time while the muscle rests, we must suppose that just an equal amount passes out of it in the same time. If not, the muscle should become fatigued from rest, which is a conclusion *in absurdo*. But if now a stimulus be applied, and therefore the production of these waste matters be increased with an amount B, the total production is A+B, and the total excretion is A+C. Nothing in our previous argument necessitates the supposition that B=C, but we may even conclude that if the work is of a high degree of intensity and consequently the amount of waste matters produced great, B may be greater than C, and in this case the result must be an accumulation in the fibre of waste matters, i. e., the muscle becomes fatigued. Now, if this accumulation once has begun, and we consider that the accumulated matters are to a great extent crystalloids, and we further remember that crystalloids, though themselves easily diffusible, are very poor media through which a diffusion may take place, while the non-diffusible colloids are admirable media for this process, we can readily see that intense activity necessitates a rest, during which the muscle may get rid of its surplus of crystalloids. The elimination must in this case, i. e., in rest after intense activity, always be intensified until the surplus is excreted.

It may now be remarked that there exist muscles in our bodies which do not enjoy a vacation from the time they begin their work until the end of life, and that consequently in them such an accumulation does not occur as we have judged to be inevitable. We answer that this is not contrary to the theoretical explanation given above, because if in our example the muscle does not contract more

than just enough to produce the total amount of waste material, which can be eliminated by the sarcolemma in the unit of time (A C) we see no reason why work within that limit cannot go on indefinitely, as far as the muscle is concerned. That it cannot do so, but a rest is found necessary even if the intensity of the work be small, depends probably on the fact that other organs are engaged in activity when the muscle voluntarily contracts. We know in life no absolute or complete muscular fatigue; if a stronger stimulus be given, the muscle will contract, however tired and exhausted it may appear to us, and it is therefore likely that it is the nervous system which first gives out. And on the other hand, we have a vast experience showing us that even the muscles with constant activity, for instance, the heart, do deteriorate if the work demanded from them is increased beyond certain limits.

"NEWCOMB."—A SUBSTITUTE FOR BASKET-BALL.

BY CLARA G. BAER, OF NEW ORLEANS.

This game is the outgrowth of a demand on the part of the members of the Class of '95 of Newcomb College, New Orleans, La., to become initiated in the handling of the basket-ball. We had ordered a set of baskets, and while patiently waiting their arrival, the substitute was inaugurated. Since then I have found it an excellent means of keeping larger classes interested in comparatively little space. This is scarcely practicable in basket-ball, when, in a room say 62x42, about forty pupils wish to engage in the sport. As no apparatus is required beyond an ordinary light foot-ball, it is practically within the reach of every one.

In aiming to make the gymnasium what it should be, a place of recreation or rest through change of occupation, the joyous abandonment that is the result of participating in lively, life-giving games is sufficient reason for their introduction. As a distinct feature in the work of the gymnasium, then, they have come to stay. It only rests with the instructors to see that the principles underlying all gymnastics are adhered to. A game, to have a place in the gymnasium, should have a purpose.

What we hoped from the "Newcomb" we have not been disappointed in. It teaches alertness, lightness; the ability to remain on one's feet; good judgment in a sure aim; gives strength to throw and power to hold. A few simple rules materially aided in bringing about the result.

HOW TO ARRANGE THE GAME.

Divide the room into two equal parts by drawing a chalk mark across the floor. This is called the "Division Line." About seven feet each side of this line draw shorter lines for the Bases. If con-

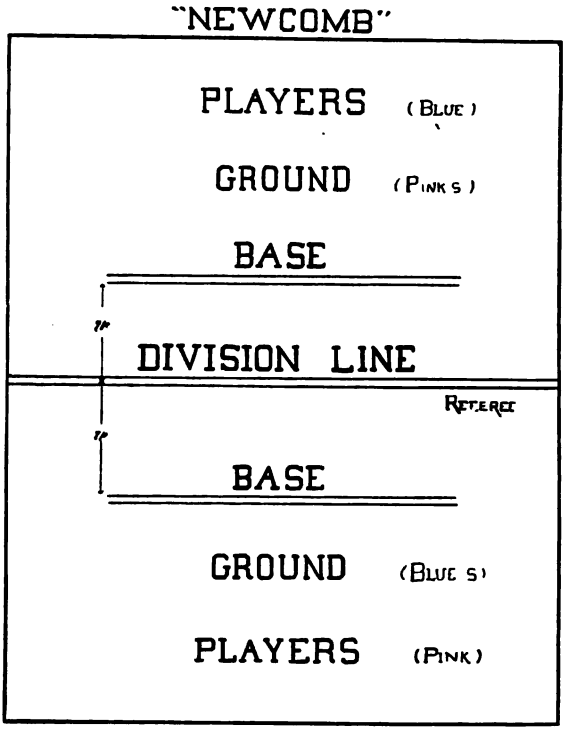


DIAGRAM OF THE ROOM

venient, it might be well to draw these with colored chalk; or, better still, have both Division Line and Bases painted on the floor (black paint preferred) from two to three inches wide.

The space between Bases is called "inside" of the Base; and beyond, where the players stand, "outside." For convenience, the players are designated by colors or numbers. If the class colors are pink and blue, one half of the class plays pink; the other half, blue. The Blues guard the ground of the Pink, and *vice versa*. The players are arranged at irregular intervals beyond the Bases, which they are not permitted to cross except when the ball is thrown up by the referee (the instructor). This is done at the beginning of the game, to decide which side shall have possession of the ball, and after each foul. If the ball is batted back into the neutral ground by one receiving it, it is called "out," and does not count for either side.

THE OBJECT OF THE GAME.

The object of the game is to make the ball touch the opposite ground beyond the Base, when it is called a "touch-down," and counts three for the side sending the ball. At first "touch-downs" are easily made, but when the players become expert in handling the ball, it is seldom permitted to reach the ground, and the interest increases proportionately.

RULES.

1. The players shall stand outside of the Bases.
2. The player shall not step inside of the Bases except when the ball is thrown up at the beginning of the game, and after each foul.
3. The ball must be thrown by the hands. It may be thrown with one or with both hands. It must not be kicked.
4. No player shall catch or throw the ball while on her knees. She must be standing.
5. No player shall fall on the ball.
6. A "touch-down" shall count three for the side sending the ball.
7. A foul counts one against the side offending.
8. A majority of points shall decide the game.
9. The referee shall throw the ball directly upward from Division Line.
10. The referee shall decide the time,—keep account of "touch-downs" and fouls.

11. If there is too great a rush for the ball when thrown up by the referee, a captain may be chosen for each side, when they only are permitted to cross the Base Lines.

FOULS.

1. Throwing the ball between Division Line and either Base.
2. Pushing a player in order to gain possession of the ball.
3. Violating rules 2, 3, 4, and 5.

TACTICS.

As the object of the game is to guard the ground on which you stand, cover it as effectually as possible by even distribution of players,—take care that the best players are not together. If you have a weak spot, try not to let the opposite side discover it, or they will throw their ball in that direction. Vary your plays. For a time, aim far beyond the Bases; then, suddenly, throw the ball just outside of the Base. This is a difficult play, and should only be attempted by one who has a sure aim, as it may lead to a "foul." For long distance, throw high, or the ball may be intercepted. A low ball, when well sent, is very effectual; for, unless a player has her movements well under control, in stooping, she is apt to fall on the ball, which counts a "foul" against her side, beside the "touch-down," if she fails to catch the ball. Whenever possible, save a player on your side from violating Rules 4 and 5.

Personally, strive yourself to be the best, for the more expert the individuals become, the better will be the playing of each side as a whole.

REPORT OF COMMITTEE ON ANTHROPOMETRY AND STATISTICS.

During the month of February, 1895, the Anthropometric Committee of the A. A. A. P. E. sent a circular to a large part of its members, notably those who were especially interested in Anthropometry, containing questions and matters indicated in these pages by the larger type.

Only a small portion of those addressed have made replies to the circular, but the data and views expressed by these members are herein offered as a report or communication to the Association, without note or comments.

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1. How many persons have you examined during the year? (a) Of what social classes. (b) Male. (c) Female.

The returns give, Men measured and observed,	8,217
Women " " "	2,731
Total,	10,948

The social classes are largely students, and not the laboring people, save the few reported by the Y. M. C. A., also from the reformatory prison at Elmira, N. Y.

2. What methods of measurements do you employ, and how do you register them? (a) Metric system. (b) English system. (c) A. A. A. P. E. (d) Y. M. C. A. (e) Other methods.

Twenty-one reply that they employ the methods of the A. A. A. P. E., sixteen the methods of the Y. M. C. A., and ten other methods, mainly those in use at Yale University.

Twenty-two make their records with the metric measures, and the same number in the English method.

3. Do you tabulate your measurements? (a) By averages, 14. (b) By means, 8. (c) By physical excellence, 2. (d) By other ways, 8.

4. Do you print your results? If so, please send a copy.

Twelve answer in the affirmative.

5. Do you employ the sphygmograph, and if so, what valuable results do you get?

Seven report its use, and these only in special cases, and those in which it is expected to find diseases or abnormal action with the possibility of treating them.

6. (a) Do you find from your examinations that you can advise and prescribe exercises and treatment that give good and constant results?

Forty-seven report a decided "Yes," and five with a qualified affirmative.

(b) Would you be willing to prescribe from a list of measurements alone?

Twenty-nine reply positively "No" and fourteen "Yes" in a very qualified manner.

7. Please note defects in the methods you use, and make suggestions of any changes that seem valuable to you.

1. Would omit "nipples" measurement.
2. Examiners should be physicians specially trained to the work.
3. Would like Dynamometers that are not awkward.
4. Too many measurements: too few strength tests. Would employ Kellogg tests.
5. Special care to get the parts of the body in proper relative positions to see that full strength is exercised on the Dynamometers.
6. The distance through which a man moves his body on Dip and Pull Up should be taken into account.
7. Knee Height as taken in A. A. A. P. E. instructions inaccurate.
8. Nothing to indicate antero posterior defects.
9. Measurements of Head, Circumference of Joints, Height of Sternum and Navel unnecessary.
10. Measurements do not show true development.
11. Would reject Pubis, Shoulder Elbow, Elbow Tip, and Finger Reach measurements.
12. Would measure legs separately, *i. e.*, each leg consecutively.
13. Would know more of ancestry, occupation, etc.
14. A. A. A. P. E. Method too severe in strength tests, *i. e.*, Dip and Pull Up for women.
15. Should take one side in order, and not right and left alternately.
16. Want of a general uniformity through the country.
17. Students fail to get the knack of using Dynamometers.
18. Strength tests are a weak point.
19. Condition of teeth, standing and sitting positions of spine should be considered.
20. If consecutive measurements are compared, they should have the same exact particulars of record.
21. Personal history of more value than measurements.
22. Need of uniformity and unity of measurements.
23. What is lung strength a test of?

8. Do you use Dynamometers, and of what make?

Fifteen use Upham's (A. A. A. P. E.), seven Tiemann's, and three Kellogg's.

9. Do you compute total strength, and if so, how?

Twelve use A. A. A. P. E. methods, and three use other ones.

10. Do you examine the eyes, and what results have you found, and do you test the other senses?

Fourteen report more or less examination of the eyes, with the finding of astigmatism and myopia. But three speak of the other senses.

11. State any result you have obtained from study of the relation between different items, such as weight and lung capacity.

A flat chest more mobile than a full one.

A person with a long, flat chest can blow more than one with a broad and full chest.

The man with the greatest capacity does not have the greatest physical endurance.

Prisoners are underweight fifteen pounds in proportion to height, and hence have small lung capacity.

12. Do you make any Psychological tests, and if so, what ones?

The only returns to this question were those of reaction time, accuracy of movement, and memory.

13. What new apparatus or device for anthropometric work has come to your notice of late?

Callipers of Schliermacher. The Sphygmo Dynamometer. Use of photography with graduated screens and kindred appliances.

Mr. T. Elkington, of Philadelphia, has a little device for measuring the length of legs. So has Dr. Wilson of the same city.

New Callipers of Aluminum made by Narragansett Machine Co.

Kellogg Dynamometers.

The Thoracometre of Demeny.

SENDA BERENSON,
JAY W. SEAVER,
E. HITCHCOCK.

PAPERS PRESENTED BEFORE THE SECTION ON THEORY AND PRACTICE.

[Dr. Mary T. Bissell in the chair.]

Dr. Bissell presented the following report: The Committee on Theory and Practice has addressed letters to most of the leaders in physical education throughout the country, inviting communications

from them in regard to any new points in Theory or Practice which they desired to present for consideration.

Such replies as have been received (which they would here acknowledge with thanks), have disclaimed any discoveries in the departments named. Many have asked for information or for discussion of questions related to physical education, some of which questions are embodied in the topics for discussion in the programme.

A noteworthy point of unanimity in these communications has been the interest expressed in gymnastic games, which, both as educational and recreative features, appear to be taking a prominent place in many of the institutions represented.

Among many practical questions we may note one which reads: "What shall be done when the teacher cannot control the dress of the pupils so as to forbid the wearing of tight clothing during gymnastic hours?" As this condition of affairs exists in many public and private schools where physical exercise is regularly given, it is a question that certainly deserves consideration.

Among propositions received we may note one which has already been referred to briefly before this Association, viz., that medical, or rather ortho-somatic, gymnastics should precede the regular work in the gymnasium.

An interesting, and comparatively new, phase of the work in physical training is its introduction into special institutions, such as those for the insane, for dipsomaniacs, and for the deaf and dumb. In several of these institutions the work has been carried on by members of this Association.

The Institution for Dipsomaniacs, at Foxboro, Mass., introduced gymnastic drill into its system about a year ago, under the direction of a member of this committee. His experience of its usefulness in this class of persons, who especially need both the mental discipline and the physical energy to be gotten from systematic training, is most encouraging, and his experience has been warmly corroborated by that of the physician in charge, who considers the drill remedial in every direction.

Another member of our Association has recently been called to introduce gymnastic drill into the Flatbush, Long Island, Asylum for the Insane. The material in such a community is necessarily difficult to manage. Great difficulty in coördination has been noticed

in this case, as well as physical weakness. Some improvement, however, even in the short period of two months, has been noted, and the further results of the experiment will be looked for with interest.

The state of New Jersey is about to erect a new institution for the deaf and dumb, and with the completion of the gymnasium physical training is to be introduced into the institution, under the direction of a physician and practical physical educator, also a member of this Association.

In view of the interest attaching to the bill now pending in the New York state legislature to introduce military drill into our public schools, and of the fact that the experience of even the most expert physical educators is seldom, or never, consulted as to the value of such important public questions, it would seem most desirable that this Association should take initiative steps to make its influence felt.

This committee would therefore suggest:

1. That the Association, through its council, or after the proposed re-organization, through the district officers, or through a special committee elected for the purpose, should, by such means as seem proper, come into such connection with the school authorities as to act as an advisory committee to them in all matters pertaining to physical education.

It would also seem desirable that this Association as such should concern itself with such public means for the physical improvement of the people at large as are represented in out-door play-grounds, which represent to many their sole opportunity for physical development with wholesome recreation.

The committee would therefore further suggest:

2. That this Association should become more or less closely connected with the societies for encouraging out-door play, wherever such exist (as, for instance, New York city), and that the members where such societies do not exist, should endeavor to interest the general public so as to create such societies.

WHAT NERVOUS TESTS SHALL WE USE TO COMPLETE THE PICTURE OF AN INDIVIDUAL?

G. W. FITZ, M. D., HARVARD UNIVERSITY.

Gymnasium tests as now taken do not distinguish the active and quick from the strong who may have nothing of that beautifully balanced control which gives the skill of the expert. The essential difference between a good tennis player and a hod carrier is of the brain, and it is necessary to have tests permitting a numerical statement of an individual's power to guide his muscles.

The ability to meet the physical exigencies of life means the power to meet the unexpected and to adapt one's self to that which comes quickly and without anticipation, hence the tests must be such as can be applied to anyone whether he has studied in a gymnasium or not and which will show his power of adaptation to environment.

It is important here to consider what kind of activity is common to all people. Every child goes through a training which begins at birth and his teachers are the things themselves, or at least the physical conditions presented which force him into a degree of accuracy which no amount of didactic instruction can make possible. This is true education and it comes to all who have the power to receive impressions and the opportunity to respond by activity. Life is made up of reactions to unexpected external conditions, and each of us is so habituated to meeting these problems that he forgets they are problems, for he solves them without conscious attention. In playing ball a boy centres his consciousness on the ball, and when he sees it coming he is able to put out his hands unconsciously yet accurately to catch it. The process is essentially the perceiving of conditions, interpreting them and making a quick motor judgment in response.

The motor stimuli are clearly reactions and as the external conditions vary the individual is forced to vary his responses, the result being that he becomes trained in skill of adaptation. These adaptive reactions are complex in that they depend in the first place upon the products of sense organs, the sensations of light, color, form, and all that make up the concept of an object and its rela-

tions to other things. From these data we interpret its weight, etc., unconsciously adapting our effort to the requirements. In this way we do many very difficult acts without realizing it, because we have done them so long we have developed the power to instantly and unconsciously interpret the conditions and to respond adequately.

The games which interest childhood and youth involve in a marked degree similar elements, and a test which shall be of value must be one which relates itself to this every-day training of life and which will measure the power thus developed. The test must avoid all forms of conventional movements needing to be learned and be clearly an adaptive movement or exercise, that is, one in which the response is natural rather than conventional, inasmuch as any hesitation or deliberation will seriously interfere with the value of the result as a test of the adaptive ability of the individual. This is one of the disadvantages of the ordinary sound and sight reactions since the pressing of the key has no natural relation to the stimulus, but is simply a thing agreed upon, whereas if something is shown suddenly it is a perfectly natural and adaptive action to reach out for it. In natural reactions there are the elements of quickness and accuracy, and in the same individual the two are related intimately, for all reactions will be more accurate if done slowly and less so if done quickly.

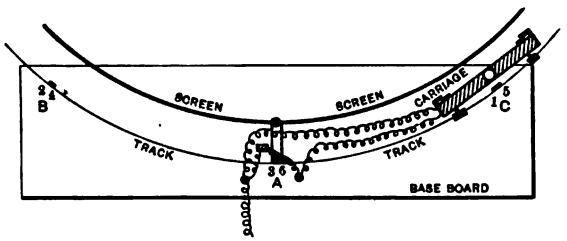


FIG. 1.—LOCATION APPARATUS.
B, A, and C—points on which carriage may be placed on track B—C.

In order to study this problem I devised an instrument[1] which I showed the Association at the New Haven meeting (1894) and which I have called, for want of a better name, the location reaction apparatus. The essential problem is to touch a white spot suddenly disclosed in an unknown position, and the apparatus is connected

[1] See article in *Psychological Review*, January, '95, for full description.

with a chronoscope which measures the time between the appearance of the spot and the touch of the finger, while the error index

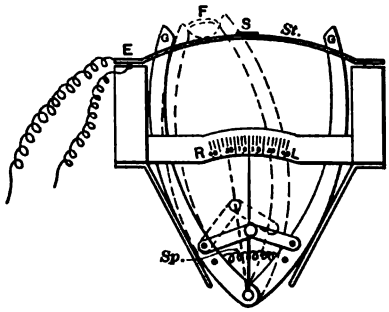


FIG. 2.—ERROR INDEX.

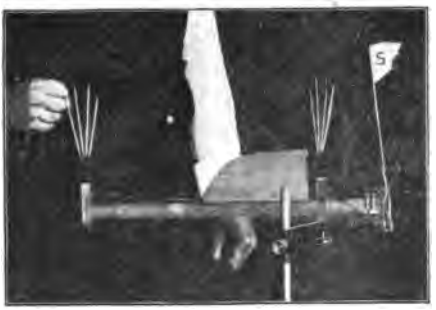
E—electrical contact; St.—horizontal strip, bearing in centre the spot to be touched (S); GG—arms, pivoted at a common point under (S); R-L—scale, graduated in millimetres; Sp—spring connecting arms, tending to pull them together enclosing the finger (F).

(Fig. 2) measures the distance of the finger from the spot, that is, the error of the movement. About eight hundred observations have been taken with this apparatus during the two years of its existence, and a study of these brings out some interesting facts bearing upon the question of tests of muscular control. In the first place, individuals vary greatly in the quickness with which they can touch the spot, while the variations in accuracy of touching are less marked. The table gives the groups classified by quickness. In the first column

	742 MALES.			116 FEMALES.		
Time in 1/100 sec.	No.	Per cent of total No.	Average error.	No.	Per cent of total No.	Average error.
29— 35	26	3.5	12.7	8	6.8	6.4
35— 45	136	18.3	12.6	38	32.7	8.4
45— 55	259	34.8	9.5	30	25.8	7.9
55— 65	205	27.6	8.2	25	21.5	7.2
65— 75	84	11.3	7.4	11	9.5	5.4
75— 85	24	3.2	4.9	4	3.4	4.4
85— 95	7	.9	5.4			
95—105	0	0	0			
105—115	1	.1	7.8			

are the limits of the time determining the group, in the second the number of individuals in the group, and in the fourth the average

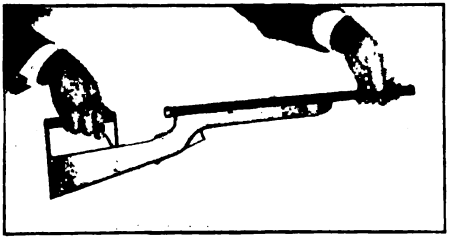
error of the group. The striking thing is that there is a fair uniformity in the average error, while the time is a variable factor. It will be noticed that one group doing the movement in half the time of another does it almost as accurately, and indeed some members of the group do it more accurately than many members of the slower group, showing that in this test there is a wide variation in the power of the individual, the variation being in the time of the response rather than in the accuracy. This is a somewhat surprising result and suggests that our every-day experience forces us into a degree of accuracy, otherwise we fail to pick up things or are clumsy, and each individual has to go slowly enough to do things accurately. Another important point is that practice makes very little difference in the test, and I think this shows conclusively that the test is a valuable one, for it shows that it is practically an adaptive reaction in which we are all trained, with the result that the additional practice got in the test, even when it extends through days and weeks, amounts to little and barely shows in the result. The best record that has been secured on this apparatus is that of the champion college tennis player. Similar records show that the power which gives rise to a good result upon the apparatus is the same power which insures quickness and accuracy in sports and games, and in the various physical exigencies of life.



Another test, which I do not consider so good, was devised by me in 1892, to test the quickness and speed of thrust in sparring.[1] The

[1] See *New York Herald*, August 14, 1892.

problem is to hold the hand in a guarding position near the first fan of the apparatus, and at the fall of the signal (S), which simulates the movement of an adversary's fist, the individual to be tested thrusts his hand forward as in striking a blow. The test is not so valuable inasmuch as it is not strictly adaptive in the sense that the location reaction is. A study of the reactions shows similar results to those of the location reaction, but not so clearly and definitely, and it seems to me that it gives no additional element of our desired picture of power.



A different test which I have used somewhat is of the sense of direction.[1] It consists of an air gun made so it can be held like a broomstick, preferably with the tips of the fingers as they are more sensitive, and pointed at a bull's-eye upon which the eyes are fixed. The record of direction is made by pulling the trigger and sending a shot through the target. Here again it seems that the practice after a few preliminary trials makes very little difference in the result. In fact, series of tests involving several hundred shots one after another and repeated at intervals of several days showed very slight variation other than a rythmic increase and diminution of the errors occurring at intervals of a few minutes, being apparently a fatigue effect. The average displacement of the hands in a series of tests of one individual amounted to two or three hundredths of an inch which is almost inconceivably small when we consider the number of muscles and the variations which enter into the assumption of the position. It is especially astonishing when we realize that there is but slight consciousness of direction, the individual having only a vague feeling of the direction of the aim and controlling it subconsciously.

[1] See "Mind and Body," June, 1894.

Another test is the estimate of size or distance which may be made by means of the simple apparatus here shown, consisting of a ruler with a wire stretched on it carrying two beads, graduated on the back and with a plain black face. This test may be made in several ways, first as a sight test, one button being placed at a certain distance from the middle post, the problem being to set the other at an equal distance upon the opposite side. Again it may be used with the eyes shut to determine the muscular sense of distance or the ability to measure by feeling the distance between the bead and the centre post and to duplicate that distance by adjusting the second bead. Of course in all of these tests numerical values may be given and the results will form the basis for a comparison of individuals.

Many other tests[1] have been devised for studying the nature of physical activity and the elements entering into the problem, but it is a question whether it will be considered advisable to put all who wish to exercise through the many tests proposed since the time required is considerable. I believe, however, that tests similar to the Location Reaction, and the sense of direction which may be taken quickly, are of value as indicators of the power of the individual to adapt himself to every-day conditions to which he may be subjected and especially as a guide to the kind of work which he is especially fitted to do, whether as an exercise or in life work. One who has a good sense of direction should be good at shooting and archery, base-ball and similar sports, while one with a good location reaction should be good at tennis, foot-ball, base-ball, and anything requiring quick adaptation.

Whether the power of an individual to adapt himself may be cultivated by means of games, is a question which I am not prepared

[1] Galton, Warner, Marey, Jastrow, Bryan, Dressler, Scripture, etc.

to answer now. There is no doubt that up to a certain point anyone improves by practice in games, but it is also true that no amount of practice will make one slow in adaptive reactions into a good tennis player, although doubtless he can improve in playing through experience in the special conditions presented by the game. Undoubtedly we have the same conditions in physical activity that are shown in mental, most persons being always poor or mediocre while a few are brilliantly skilful. In the first place we must give an individual the training which will lead to the needed growth for his complete development but we have to guard against the wasting of time in attempting to accomplish the impossible. An important consideration lies in the fact that we are now unable to measure the educational value of gymnastics and it seems to me that only through these tests can we actually show in the first place the need for educational gymnastics in the schools, and in the second place determine the kind of exercises which are really educational in the sense that they develop the power of the individual to adapt himself to his physical surroundings.

DISCUSSION.

PROF. CATTELL of Columbia College.—I need scarcely say that Prof. Fitz's paper was of great interest to me. I think our physiological and psychological laboratories should coöperate with you who are engaged where you have better opportunities for making mental and other tests. We who are working in the laboratory have much to learn from your practical experience, whereas in accuracy of method we have some things that we can teach.

The only criticism that I should make on Prof. Fitz's paper is that the method is somewhat complex for the purpose for which it is intended. The apparatus itself is rather complicated and liable to get out of order, and would probably require some skill to use it. The results are also somewhat complex. We have here the time, which increases within wide limits, and the accuracy, which decreases within wide limits. If we could measure those two things singly I think it would be better, because we do not know in these cases how far the people who are slow and accurate could have been quicker and less accurate. At the same time, I feel sure that

the introduction into our schools of such experiments would be of great value.

I have here several sets of experiments, such as we make on the freshmen entering Columbia college, and again during their course. They are intended to measure physical efficiency, and also mental quickness, range, and the like. [Papers distributed.] There are, for example, on that card five hundred letters, one fifth of which are A's. The student is required to mark as quickly as possible all the A's on the list. The time is easily taken without any complex apparatus and we have a measure of the rate of perception. In the case of a movement, we can measure its quickness, its strength, or its accuracy, and we can measure each of these singly as well as complexly. It is very important to make, not only measurements of the maximum strength or the maximum rate of a movement, but also of its accuracy. This can be done in the case of quickness very readily with an instrument such as Professor Fitz has exhibited. The accuracy of the force of movement can be tested with an ordinary hand dynamometer, such as most of us use. You can press to a given amount, and then see how accurately the pressure can be repeated. The accuracy of the extent of movement can be measured by letting the observer make a given movement and repeat it as well as he can with his eyes closed.

The time it takes different individuals to make a blow 50 cm. in extent only varies between .075 and .150 sec., and one who makes a blow in .075 sec. may have a variation of perhaps .005 sec. Professor Fitz did not give us the accuracy with which an observer repeats a movement from time to time. That would show whether practice is needed to give a maximum of efficiency. I should suppose from our ordinary athletic exercises, such as fencing, that there would be an improvement with practice.

I have ventured to make one or two criticisms in my remarks, not meaning to overlook, of course, the great value of Professor Fitz's method. By an original device, he has added new means for the investigation of phenomena of great theoretical and practical interest.

Dr. Arnold.—The table that Dr. Fitz has given does not specify the age of the person tested. I suppose that Dr. Fitz only measured the reaction time, etc., of students at Harvard. It would be

interesting in the extreme to know how children would behave under brain tests, and how far with them training, which now seems to make no great difference in the tests, would improve accuracy, quickness of movement, etc. That would be a great help in the teaching of educational gymnastics, a great help to teachers who wish to employ educational methods. I would like to ask whether those experiments were made only on students, or on children too?

Dr. Fitz.—I would say that Dr. Arnold is correct in this. It has been a lack of opportunity rather than of intent, and I hope to extend the tests so as to take in all ages to determine the development of accuracy and quickness; but time, of course, is required to do this, and opportunity has not been furnished. I would like to say, in connection with the points taken up by Professor Cattell, that I did not attempt to analyze the results given by the apparatus because the limits of time which I gave myself for the paper did not permit. I have taken a large number of tests of single individuals, and have found that the variation of that individual is very slight. The variation of error and of the quickness are both comparatively slight. The increase in accuracy by practice is not shown in this; and I attribute this to the fact I mentioned in the paper,—that it is so nearly related to ordinary activity that the amount of practice which is obtained with the apparatus amounts to very little in comparison with the practice we are getting every day by our reactions to the conditions presented. Hence it shows that the apparatus is specially valuable, inasmuch as practice does not cut any figure, and especially as it is similar to our ordinary activity, so that any one can immediately perform tests and get the measure of his quickness and accuracy, or get one element for the formation of the picture. It seems to me that is a very important consideration; and so far as the apparatus is concerned, the complexity is not so apparent as it seems at first sight. The apparatus can be made so that there is very little liability of getting out of adjustment. The tests are physical rather than mental. It is simply the ordinary activity of animal life which is tested, but it is mental in the sense that our brain centres are involved; but they are not the deliberative centres, or those which are concerned in the solving of purely abstract intellectual problems.

Dr. Beyer.—I haven't any expensive apparatus, but I have been

in the habit of taking the average reaction time, not having an apparatus to ascertain the individual reaction time; and the most convenient way that I have used for a year or so is to range the students in line. I call their attention to the fact that I am watching them. There are forty of them. I have a stop watch at one end, and I have them count fours. Just as soon as the first one gets done I start the watch, and when the last one counts four I stop it. Of course it is a very rough test, but when you average it something of an idea can be gained. I found that within a month the average reaction time went down from .35 of a second to .29. I noticed there were gaps between two slow individuals,—some were quicker and some were very much slower; but it seemed to encourage them very much when I told them that they had improved to that extent, and it seemed to sharpen their wits and to arouse a great deal more interest in that method of testing their mental powers than anything else.

Dr. Shaeffer.—I believe the time will come when there will be a class of men specially trained to stand between the parent and the educator. They will take the place of the modern phrenologist. The demand is already expressing itself. I have heard of a case where the physical director of a college has been employed by parents to give their younger children the same kind of anthropometric examination and counsel. It has been suggested that it would be desirable that every pupil entering school life should bring a statement from the family physician as to constitutional weakness. I see in these improved methods of testing what you may call the neuro-muscular efficiency of a person, very decided adaptation to that class of work. It will be feasible to size up an individual early in his life, from a knowledge of his inheritance and actual endowments at the time, and in some way to indicate what is the future, and line of success for that individual.

Dr. Arnold.—I should like to have tests of the sense of touch, as far as discrimination of different weights and pressure is concerned. We have had some such, but we have no clue as to how these might be affected by development and exercise.

Dr. Fitz.—There are a large number of tests which may be used. My paper was intended simply to be suggestive, and not at all to be exhaustive. I would suggest as a very important opportunity

for our Association, the formation of a committee or a commission to consider what nervous test should be applied and to formulate the best methods for their application. It seems to me that in this direction lies the progress which is to come in our work in the immediate future. Anthropometry is pretty well determined now, and the finer study of anthropometry can be made practically upon the data that we have at present; but this line is entirely a new one. We have systems of all sorts, and we stand before the country to-day with many rival claims, based upon all sorts of psychological and physiological suppositions—many claiming to be above educational and to combine or include in themselves all truly educative exercises. What tests have we of the educational value? What has any system shown that gives the right to speak of educational results? We have no right to consider that the learning of conventional movements is educational unless they lead to increased power of the individual to adapt himself to his surroundings, and so we are all at sea until we have some tests that definitely show the results of training.

One study which I have made in connection with this was the relative accuracy of the use of different fingers as touching agencies. The individual was called upon to touch with the index finger, and then immediately afterward to touch with the little finger. Of course that made a complete adjustment necessary, for in the first place the hand was thrown to one side and in the second place to the other side. One would suppose that would greatly increase the error, and personally I was very much surprised to find that in each case there was very great accuracy, and no more lack of it in the case of the little finger. Yet the consciousness was directed upon the spot, and the individual was almost unconscious of his hand, and certainly not conscious of the muscles that controlled the movements,—showing how very accurate and quick that control is. It seems to me the claim that movements must become conscious in order that one may gain control of muscles is hardly proved, and rather absurd; for if we are trained by this every-day activity we are able to make this adjustment without conscious attention, and if comparatively young persons are able to do it accurately and immediately, what is the need for that training? These problems lie before us, and the question is, how shall we solve them? It seems

to me that we have here an opportunity of determining exactly what is the real need, from the educational standpoint, for the development of the power and the best means to accomplish it. I move that there be a committee appointed to consider the nervous tests which should be used in connection with the strength tests in the gymnasiums.

DR. HARTWELL.—I second the motion. If I may be allowed to amend it, I prefer that the National Executive Council of the Association which is to come into being after the first of June be recommended to consider this question and to report upon it at the next national convention.

DR. FITZ.—I accept that amendment.

DR. HARTWELL.—In support of this amendment I would say that it is perfectly clear that the educational value, using the term in a strict sense, of different forms of exercise, except in rare instances, has not been thoroughly determined or clearly apprehended either by those who teach gymnastics or those who devote themselves to psycho-physics. Physiological psychology is a tolerably new science. If we look through, or do no more than glance at, such studies as physiologists have made with regard to exercise and its effects we shall find so many divergent views, and such a variety of opposing methods based on contradictory results, as to afford ample justification for the Executive Committee of this Association to appoint a special committee to sift the whole matter. Such a committee should by no means be composed exclusively of members of the Association. If we get the aid of competent experts and consider the physiological and psycho-physical problems, pertaining to muscular exercise, we may sift out enough of truth to secure as a working guide a temporary hypothesis, pending the complete and conclusive determination of the relations between the mental and purely physical sides of exercise, and of the relative value of sensory and motor tests of the effects of neuro-muscular training. I am very glad that Dr. Fitz has brought up this matter in just the way he has, and that Professor Cattell has expressed himself as he has, because it seems to me that we shall get into hopeless depths, if we do not have our theories and methods of instruction square with the work done in the psychological and physiological laboratories.

Dr. Fitz's motion was passed.

VERTICAL SCRIPT AND PROPER DESKS AS RELATED TO EDUCATION.

BY EDWARD R. SHAW, PH. D., OF NEW YORK UNIVERSITY.

Dr. Herman Cohn, in speaking of vertical writing, says, that with the slanting script one never knows whether a pupil sat upright or not. With the vertical script he must have sat upright while writing it. Dr. Cohn is clearly wrong in this statement. The use of vertical script in itself cannot be relied upon as evidence that the pupil sat upright while writing it.

In visiting the schools of Glasgow, Govan, Edinburgh, and London, last year, I saw thousands of pupils at their writing, and with the exception of one school in which Vere Foster's system was used, which is a slant of sixty-five degrees, all were using the vertical or upright hand. By actual count in each school, noting down those who sat in good position, those who sat in fair position, and those who sat in very bad position, I found that the percentage who sat in a good position was not greater than the percentage in schools in this country where the slanting hand is being used, and where the teachers urge pupils constantly to sit as straight as possible. The percentage of bad positions, where pupils sat with one shoulder higher than the other and with curved spine, was surprisingly large; and had I not counted the number in each school, making a record on the spot, I should have been inclined to regard the truth of such a statement as I have made in relation to vertical writing with considerable doubt. There is one other point which ought to be stated here, and that is that in many of the schools there was a disregard of the proper position in which the paper or copy-book should be placed upon the desk.

It is only a little more than two years that vertical writing was first adopted in this country; since that time its adoption has spread with great rapidity. To-day vertical writing is driving out the sloping writing on the ground of greater legibility, and because it is much more easily learned and taught. These points alone, its great legibility and the ease with which it is taught and learned, will ensure its general use in all our schools. These two points

will carry it, notwithstanding the claim of the advocates of sloping writing that the use of the vertical hand does not ensure correct posture and therefore does not prevent spinal curvature. This claim of the advocates of sloping writing shows that there is a fundamental misconception in the minds of teachers and those interested in our schools in relation to vertical writing.

Vertical writing is a reform not merely as to the style of the letter, but it is primarily a reform as to posture in writing—that to prevent spinal curvature the pupil should sit in an upright position with the paper placed directly in front of him, the edges of the paper parallel to the edges of the desk, and that with this posture he will write vertically. It is not, then, a change in the style, but it is a change in posture, and the vertical hand, naturally, grows out of this posture. Where, then, there is one school in which the proper conception of vertical writing maintains, we find ten schools where vertical writing is used not because of posture, but because of its legibility and the greater ease with which it is learned and taught. This rapid spread of a wrong idea in relation to vertical writing is due to the fact that the incorrect idea has been spread by commercial people. These people have not understood the matter, but seeing that a demand would arise, have issued copy-books without having carefully studied the subject. That is the penalty which American teachers are paying, because we have no profession of teaching in this country to control these matters.

In Germany it is different. In all the schools in Germany where I saw the vertical writing used, the German teachers put the stress upon posture; that was the main point in all their use of the vertical script. The idea in Germany spread first from professional teachers, and the publishers there were guided by the intelligence of professional teachers.

The Kingston (Ontario) schools, in 1893, adopted the vertical writing. It was the first place in America in which it was used. In the fall of 1893, after seeing their exhibit at the Columbian Fair, I visited Kingston to study the writing. I found there the posture in writing very constrained. This was due to two facts: First, the way of holding the pen, the conventional position of the writing-master being used; and, second, the books, although placed parallel to the desk, were moved somewhat to the right. Ease of pos-

ture and a natural movement were not taken into consideration. The teachers were securing some very excellent results so far as legibility of letter forms was concerned. The mere novelty of the system, the enthusiasm on the part of the teachers, together with the fact that the poor writers were able to start anew, as it were, and become very legible writers by its use, carried the matter. But had correction been made in the position of holding the pen, and had the writing page been narrower and placed directly in front, even then the results, considered from the standpoint of good posture, would not have been such as ought to be secured. The desks were at fault. I saw then the same difficulty which has beset all later attempts at using the vertical script. The results that ought to be obtained in posture, rapidity, and freedom of movement, do not come because of the desks used in our school-rooms.

Recent observations and measurements upon more than 200 children in the 3d, 4th, and 5th grades, or school years, who have been using the vertical script for about a year and a half, show that with attention to correct posture, the evidence in favor of vertical writing stands 80 per cent. of fairly good postures to 20 per cent. of bad postures, considering only the matter of lateral curvature of spine. These percentages are about the reverse of those which were noted in the study of the same pupils before changing to the new posture and vertical script. In other words, there is a gain of 60 per cent. in postures that are fairly good, considering only lateral curvature of spine. Now, gratifying as this showing is, the observations further showed that there is a bending of the body forward and the neck down in most cases, while with the remainder the shoulders are raised too high and the elbows spread out—faults of posture which cannot be overcome with desks as now constructed. Even the adjustable desks as to height remedy these faults but a little, because of the slope of the top, and because they are not adjustable for minus and plus distances.

In the directions for vertical writing given by the German physicians who investigated this whole matter of handwriting so elaborately, the arms are to be held a hand's breadth from the side. This gives opportunity for an active tension of the muscles of the back, which is necessary to preserve a straight, upright position, as Dr. Hertel, of Copenhagen, has so cogently pointed out. When

the elbows are thrown out and the forearms are upon the desk, those muscles at the back are not in the state of required tension, and the head falls forward and the chest contracts. Those who have seen the cuts made from photographs issued by Jackson, the author of the "Theory and Practice of Handwriting," and the English advocate of vertical writing, must have noticed the spread of the elbows which he allows, as well as the position of the hand in holding the pen. In both these particulars Jackson is wrong, and flies in the face of all German authorities.

What the child needs in learning to write is freedom for movement. If the desk is too high, he must spread his arms. This results from his efforts for more freedom. If the desk is too low, or is not arranged for minus and plus distances, the pupil bends forward and drops his head down. With these observations, I set to work to produce a desk in which such tendencies and faults should be overcome. I wish to say at the outset, in placing this desk before you, that I have no financial interest in it, nor have I had any, except that of out of pocket.

Desks with a double top, one part of which slides toward the pupil, have been made in Germany for several years. These, however, are not only cumbersome but expensive to make. My purpose was to devise a sliding top in some simple way, in order that the cost of the desk might be but little, if any, above the cost with stationary top.

The desk has one or two minor faults. Some object to the hole made by sliding the top down, but during the past year this has not been found at all objectionable. Then, at a small cost, a narrow lid on hinges can be attached, which overcomes this objection. Some think that the box is not large enough, but books can be arranged in it more compactly, because the pupil can see to do this easily. My sole aim has been to stimulate invention in the direction of desks adjustable for minus and plus distance. There are now at least six different kinds of desks and seats adjustable as to height which have been invented in a very short period. But chairs and desks adjustable as to height are less than half a step towards the embodiment of the hygienic principles of seating. Desks must have a proper slope, and be adjustable for minus and plus distance as well as for height.

The figure shows the desk closed, while the dotted lines indicate how far the top may be drawn down. When the top is pushed up, the plus distance is one and a half inches; when drawn down, the minus distance is three and a half inches. The slope of the desk is thirty degrees—the same slope recommended by the Vienna commission appointed to consider the hygienic construction of desks.

During the past year this desk has been used in a private school in this city with very gratifying results as to posture, as you can see from the photographs taken while the pupils were writing. Good postures were easily maintained.

But to return to the question of vertical writing. On the ground of rapidity, there is a seeming claim against vertical writing by the advocates of the sloping hand. Even Javal holds that with sloping hand and oblique position, while there is curvature of spine, yet greater rapidity can be secured. It is, after all, a matter of muscles habituation, and I doubt the truth of what he says.

By actual measurement the distance traversed by the pen is 40 per cent. longer in Spencerian than in vertical script. A desk that gives ease of posture and freedom for movement in the period when the pupil is learning vertical handwriting will, I thoroughly believe, produce faster writers than by the Spencerian system.

In making tests upon upward of 3,000 pupils in regard to writing, and noticing the slow progress and the toil involved, the impression made upon my mind is that learning to write—almost purely a mechanical matter—is a terrible ordeal for the child. It should, then, be made as easy as possible. As the result of my studies thus far, I would say that for the first two years of school life, the child, in any imposed writing or ciphering exercise, ought not to use pencil or pen, but should write on the blackboard.

During this period the child has not reached that stage of muscular control and coördination that will warrant keeping him at the desk to write or cipher. Notice children at this period, even with vertical script, and you will find much twisting of the body from right to left and from left to right, due to lack of muscular control.

In a careful trial this last year I found children in the first and second grades greatly helped in the matter of muscular control by writing on the blackboard with the left hand in alternation with the right, though much less time was given to the left than to the right hand.

When the child is put to writing at the desk, he should use the forearm movement, make large letters, thus moving the pen through large curves. All finger movement prevents freedom, and used too early hinders the child in gaining the best muscular control. The gain made in rapidity by using the fingers will come naturally later and of itself.

If boards of education and superintendents insist upon the use of pen and book in the second year, then it would be best to give tracing books and require pupils to use forearm movement in tracing,

having the letters with body one half inch high, and to insist upon movement rather than upon nice form. The great difficulty is to-day that teachers look to nicety of form rather than movement and muscular control. This requirement must change. Secure movement and muscular control, work for this end, and not only will nicety of form come later, much later of course, but it will remain. To aid greatly toward this end, we must have not only seats and desk adjustable as to height, but with a slope of fifteen degrees, and adjustable as to minus distance.

DISCUSSION.

DR. HARTWELL.—This matter of desks interests me much, and school-seating concerns us physical training people very much. At least it does in Boston, where we are allowed only sixteen minutes a day in the grammar-schools, for gymnastics, as an offset to the ill effects of sitting by the hour at improperly constructed desks. I cannot say just what the percentage of those misfitted in all our schools may be, but in 100 sample rooms I found only 18 in which there was not gross misfitting as to height of chair.

I will instance a third primary class, made up of children in the first year of school above the kindergarten. It was fitted up in a haphazard way by certain employés of the Public Buildings Department. According to the requirements of our conventional system of seating, there should have been a considerable number of 7s and 6s provided, but desks and chairs were all 5s or 4s, and the result was that 87 per cent. of the children in that room could not rest their feet on the floor, and more than half of them could not touch the floor with their toes. That happened in the city of Boston last autumn under what is alleged to be a system of seating. That, I take it, is about as bad a case as we can find. In point of fact, the school authorities are really at the mercy of an outside department.

In another district adjustable desks and chairs were put into a new primary school building. I had all the children measured to determine how the adjustable desks should be assorted in the new building. In the old building I found 47 per cent. of the children misfitted. That is doubtless in excess of the average misfitting throughout the city, but in the 82 per cent. in the 100 sample rooms

already alluded to, I found that 20 per cent. of the children were misfitted.

Such conditions in seating necessarily constitute an obstacle to the success of school gymnastics. What can you expect of sixteen minutes gymnastics daily, be the exercises ever so rational and well carried out, if anywhere from 15 to 20 per cent. of the children are required to sit in chairs for several hours a day, under conditions which must lead to weariness and to distorted and deforming positions? That is the question. Owing to several outbursts of inventive genius among janitors and others within the last few years—though the first adjustable desk was patented as long ago as 1840, it affected the educational public not in the slightest degree—we are now in the midst of a school-desk war. We have offered us, desks and chairs that can be raised and lowered. Thanks to Dr. Shaw's device, we have at least one desk, in sight, whose top can be placed at a plus or minus distance at will. Adjustability for distance is a prime requisite in a desk which shall meet the demands of the reformed systems of writing. European inventors have held this point steadily in view, and have produced a much larger number of devices for securing change of distance, than for changing the "difference" in height between desk and chair. The contrary is true of American inventors. The slope of desk plate adopted by Dr. Shaw is a real improvement over that usually adopted; but it is such a departure from the traditional slope that the regular purveyors of school furniture will not be likely to adopt it in a hurry.

What is called adjustable furniture in the United States is not so in the strict sense—it is only semi-adjustable. The ideal adjustable seat is one that is automatically adjustable. It ought to be adjustable for height and depth of seat, for distance, and for height of back rest in the lumbar and shoulder regions.

Dr. Schenk, an orthopedic surgeon in Berne, has invented a device which removes one of the objections mentioned by Dr. Shaw. His aim is to provide an automatically adjustable desk, at which either the teacher or a young pupil can be seated comfortably and correctly when writing; and he has succeeded so far as the automatic adjustment of the desk plate, "for distance," is concerned. The desk has a swinging desk plate, which can be placed at a plus or minus distance from the seat, by the person occupying the seat.

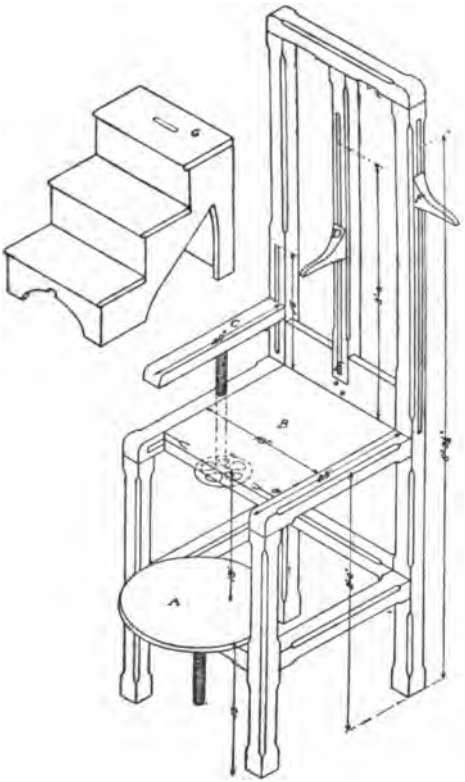
The only direction necessary for its use is "to grasp the desk plate in front of you and pull it toward you until the back of the upper arm strikes the back of the chair." By pushing the plate in the contrary direction, a plus distance is secured. His chair seat, which is a flap seat, which is turned up when the child wishes to stand up, is not adjustable for height from the floor. The foot rest is made of wood, and is of triangular shape in its cross section. It may be revolved on its long axis, so as to afford an inclined base of support to the sitter's feet, at different heights from the floor. Schenk's is the very simplest form of adjustable school desk that I have seen described. I have not seen it. It is called the "Simplex."

Given adjustable school furniture, what measures shall we take to fit it accurately to the forms of the children? If we stop to think of it, we shall readily admit that it is quite as important for the child to be accurately fitted in respect to the height of his knee, and depth of his chair seat, the length of his femur, the height of his back support, the height of desk, and the distance of his chair from the desk which he uses for his writing and drawing, as it is that shoes and collars and waist-bands shall fit him, or even that the lenses of his glasses shall be accurately ground to fit the peculiarities of his eyes. By examining the eyes of his patient the oculist obtains data for the prescription which the optician has to follow in fitting the patient with proper glasses. If we admit, as I urged yesterday, that the ratio of length, arms and legs, to total height is different in the two sexes, and varies, at different ages, for each sex, it would seem inadvisable to rely on a single scale based on average measurements. Why not examine each child, and determine the difference, distance, etc., at which his individual desk and chair should be set?

In order to facilitate the measurement of trunk, knee-height, elbow-height, etc., I have attempted to devise a measuring chair, which I propose to call the Boston School Measuring-chair.

This figure is a reproduction of the working drawing used in the construction of the Boston School Measuring-chair. The framework of the chair is not adjustable. The seat B, the foot-board A, the arm-rest C, and the cap-pieces D and F, are adjustable. The seat B is placed thirty inches above the floor, to enable the observer to read the metric scales (not shown in the figure) without his having to crouch. The steps G are for the use of the sitter in

mounting the chair, A being a foot-rest and not a step. The seat B is made to slide forward and backward, so that its front edge can be brought into contact with the posterior surface of the leg, in the



hollow of the knee, where the leg makes a right angle with the thigh in the knee-joint. The feet are to be placed flat upon the foot-board A, which can be raised and lowered by a rotary motion. The arm-rest C can also be raised and lowered to provide a firm support to the under surface of the forearm, when the latter makes a right angle in the elbow-joint with the arm of the sitter. The vertically sliding cap-pieces, D and F, are used in determining sitting and standing height respectively.

When the occupant of the chair sits erect, having his back against the back of the chair, his feet resting flat upon A, the posterior sur-

face of his leg (which is flexed at a right angle to the thigh), being in contact with the front edge of the seat B, his forearm (which is bent upon the arm at a right angle in the elbow-joint), being supported by C, and the cap, D, resting lightly upon his head,—the observer has but to note the following distances to secure the data requisite for prescribing the dimensions of the seat best adapted to meet the individual needs of the sitter. Those distances are: (1) the distance of the under surface of D to the upper surface of B, which equals sitting height; (2) the distance between the upper surfaces of A and B, which equals height of knee; (3) the distance between the front edge of B and the back of the chair, which equals depth of seat; and (4) the distance between the upper surfaces of B and C, which equals the difference, which being added to A B, height of seat, gives the height of desk. The height of desk may be directly deduced from the height of C above the foot-rest. The height of lumbar back-rest is easily determined by noting (on a metric scale placed on the middle pillar of the chair-back) the height of the lower ribs and of the upper border of the pelvis.

The measurements of each child observed being recorded by the master, or other competent observer, on a specially printed card, which bears the name, class, and number of the child, that card will serve for the accurate guidance of the janitor in adjusting the seat and desk assigned to the child, until the growth of the child necessitates re-measurement and a new card. For adjusting the semi-adjustable furniture now in use in our schools, it is necessary to know only the distances A B and B C in each case. If we shall ever have completely adjustable chairs, the measuring-chair will enable us to secure all the data requisite for prescribing their proper use.

Dr. Arnold.—I am somewhat interested in this subject, and my attention was called last year, by Dr. Hartwell's report on bibliography, to the report of the commission he has been speaking of. This commission have found that a good writing position is dependent upon these factors as they claim (1): vertical writing; (2) good desk material, as adjustable as it can be made; (3) discipline in sitting; and (4) no fatigue. I think all the attempts that are made with vertical script and improving desk material will not prevent absolutely the occurrence of scoliosis, if discipline, *i. e.*, the

teaching of a good sitting position, is not taken care of, and if children are kept in writing position for too great a length of time; I think it would be a very wise measure if we had an abstract of the report of this commission.

DR. SHAW.—I am very glad that the gentleman has brought up the matter of fatigue. I did not care to touch upon it in my paper, because the investigations thus far are not complete; but so far as we have gone these facts seem to be shown: First, that girls tire much more easily than boys in the writing exercises. That would seem to show that there must be longer periods of rest in writing, or more freedom, for the girls. Second, the indications seem to point further to the fact that girls become confirmed in their muscular habits, so far as writing is concerned, earlier than boys. The matter of fatigue must be taken into account in the teaching of writing.

DR. SEAVER.—We have present with us a gentleman that, I am sure, we would all like to hear from. He has been interested in this subject of vertical script for a number of years. I invite Mr. Wm. Beverly Harrison to say a few words.

MR. HARRISON.—One or two subjects in connection with physical education have not been brought out at all,—the question, for instance, of educating both hands, and the matter of fatigue.

DR. SHAW.—I think we owe some debt to Mr. Harrison because he is the first publisher that advocated the vertical style of penmanship. In the reference to publishers in my paper I spoke from the professional point of view when I said that wrong ideas as to vertical writing had been disseminated by them; yet, at the same time, we must remember that no little is due to them for doing what they have in putting forth books and advancing the reform, even though it carry error with it. There is one other point which might properly come up here, and that is the effect upon the eyesight in using copy-books with glazed surface and blue ruled lines. The English, I think, are ahead of us in this particular.

MR. HARRISON.—In the matter of vertical writing, I think it should begin, not in the primary school, but in the kindergarten. We begin it by teaching children to recognize the beauty of regularity, and we take vertical writing because that would establish in the minds of the children but two fixed lines, the vertical and the

horizontal. If they can recognize that those are beautiful, they have the style of good writing, whether we slope the letters or not; and you can correct any child's exercise at any time by pointing to any letter, or series of letters, and calling attention to the fact that the lines are not parallel to each other. That is the secret of all good writing. It seems to me that it has not been pressed at all. I would like to hear from Dr. Shaw about the use of the left hand.

Dr. Shaw.—The question of the use of the right or left hand is rather serious ground to tread, and I am not going to be drawn into a discussion of it. I can only give you an account of some experiments which I have made during the last two years. With city children, who have not the opportunity for out-door exercise or physical activity that country children have, in studying their writing I have found a great many twistings, because of a lack of muscular control, of which I spoke in my paper, and the thought came to me: What would be the result if I employed the left hand a great deal in drawing and writing? Simply employing it, I found that it helped the children to muscular control and helped their writing, because they were more able to keep themselves in an easy position, and would tire less by using the left hand a good deal in the second and third, and even in the first years. That is all I am willing to state on that point.

Dr. Arnold.—I would like to speak on the question of right- and left-handedness. If right-handedness produced scoliosis, why should not the human race, which has been right-handed through all these generations, with very few exceptions, be the proud possessors of scoliosis, to the left or the right? The causes of scoliosis are not muscular at all. That theory has been very thoroughly exploded I think. I think that fatigue has more to do with the causing of scoliosis than any other one factor. I think that both arms ought to be supported. The matter of fatigue, I think, is of utmost importance, for by long sitting those muscles which hold the trunk in the erect position ultimately become exhausted, and quit work. Then by what do we sit? We sit by holding ourselves mainly by ligaments—the muscular apparatus will revolt against any disturbance of the equilibrium. Such revolt does not take place in the ligaments, which are very peaceable structures compared with the muscles, and as soon as fatigue takes place the great danger of

scoliosis arises. I think that is the place where the no fatigue comes in as a prevention of scoliosis. If standing work were used in schools to interrupt sitting, I think we would have less ground to complain of scoliosis.

Dr. Beyer.—While I admire the strength of Dr. Arnold's argument on the question of fatigue, I do not feel like accepting his theory entirely, for the simple reason that the observations which I have made where I am on duty would go far to convince me that we cannot, notwithstanding modern publications, entirely exclude the production of lateral curvature of the spine. I have noticed at the Naval Academy, during the second year, when fencing and cane exercise, bayonet exercise, and all these exercises are begun that are more or less right-handed, that the examination of all those cadets at the end of that year always gives me a certain percentage of lateral curvature of the spine. They are not sitting when they acquire that; they are actually engaged in very hard, prolonged, right-handed, muscular exercise, and I get just such a curvature as would indicate right-handed work. These are not pronounced cases: we have different degrees of scoliosis. It is simply a normal deviation of the spinal column, owing to increased muscular exercise on that side of the body, hence we have the resulting curve to the left. It is easily corrected. I have had very good success so far as the cure of the trouble is concerned.

I want to say that I think in New York city the argument that muscular exercise is not productive of spinal curvature will not hold, because we certainly have any number of spinal curvatures that can be traced, without any question, to faulty muscular conditions and faulty work of the muscles on one side of the body. I am sure that the muscular condition stands in the causative relation at the Orthopedic Hospital for Ruptured and Crippled, and I am sure Dr. Taylor, and other orthopedists in New York city, will emphasize this as a cause of lateral scoliosis.

MILITARY DRILL IN THE PUBLIC SCHOOLS.

BY CAPT. EDWARD H. BOYER, OF NEW YORK CITY.

I am indeed fortunate in being permitted to be a listener to the discussions of such a body as this. I must confess that since I entered this room I have felt that I was somewhat presumptuous in offering to address you on the topic assigned to me. Military drill in the public schools is a new thing only in the sense of its proposed universal adoption. It has been a subordinate feature of school work in some of our great cities for many years. In New York city there have been military companies in many of the public schools for the past thirty years. It has never been made a leading feature of the school work, however, nor should it ever be so made.

Of the advantages to be derived from military drill in the schools I shall not attempt to speak except in the light of experience.

In the school under my charge—Grammar School No. 87—there has been an organized battalion of school boys under drill for the past two and a half years. I find that the members of this battalion excel their fellow-pupils in their prompt and unquestioning obedience to constituted authority, in the poise of their heads, in the erect and manly carriage of the body, in readiness of comprehension and willingness to learn from any source capable of imparting knowledge; in fact, in all those qualities which may be comprehended under the general term soldierly. This is the condition of things as I find it in Grammar School No. 87. As I assert this condition to exist, I afford the only proof in my power of the truth of the fact. In this lies the difficulty of any advocate of an experimental change.

The benefits of military drill, as set forth above, are counterbalanced, it is claimed by those who oppose its introduction into the schools, by the asserted fact that it makes boys bloodthirsty, fills their minds with false notions of military glory, and distracts their attention from study.

In answer to this, I can only reply, "It does not." The most studious, the most successful, the most courteous, and the most gentle boys in the school are those who stand highest on the battalion rolls as attentive and skilled soldiers in every branch of their military drill.

Far be it from me to enter upon a discussion with the trained intellectual athletes of this Association upon the relative theoretical values of military drill and of general gymnastics in the physical development of boys.

I simply claim for military drill that it furnishes to every boy an incentive for bodily development. He takes the setting-up exercise and practises it that he may become the better soldier. He plays vigorous out-door games, and glories as a soldier in the physical energies he thus develops.

Every child lives in a realm of the imagination. Military drill incites in the mind of every boy engaged therein images and emotions as lofty and as patriotic as ever incited heroes to deeds of daring. Every boy who follows a drum-beat feels within him the same heart-throbs that inspired Washington and Greene, Putnam and Marion, Decatur, Perry, Hancock, or Cushing.

I claim for military drill that it not only serves as an excellent means for physical development, but that it makes the boy regard his physical training as a part of his preparation for the duties of citizenship. It is good for the boy; it is good for the school; it is good for the country.

DISCUSSION.

Dr. Sargent.—I have listened to the gentleman's paper with a great deal of misgiving as to what part of the subject he would attack. I regret very much that I cannot agree with him in many of his conclusions.

I want to call the attention of the members of the Association, first, to the extent of the movement that is being made throughout the country to interest the public in military drill as a means of physical education. There may be moral, sentimental, and political reasons for introducing military drill into our public schools, but I must leave our brethren of the church, and the advocates of freedom and of universal peace, to meet those arguments. But when it is proposed to introduce this subject into our schools as a means of good, all-round, harmonious physical development of the individual, I, for one, must beg to protest. It is the duty of the members of this Association to inquire into the means of effecting physical development. As students of anatomy, physiology, and animal mechanics, we

have a right to be considered experts as to the relative value of different forms of physical exercise and muscular movements. With all due respect, therefore, to the advocates of this movement, let us examine this question as students of science, as we would a dumb-bell drill, an Indian-club drill, or any other form of physical exercise.

We all know, or think we know, the physiological requirements of a good exercise. These are, briefly, that the exercise should be interesting enough to engage the attention to start with; that there should be weight or resistance to be overcome; that there should be vigor and activity of movement; that as many muscles as possible should be brought into action; that the heart and lungs should be involved; that there should be alternation of movements and no tetanized movements; that there should be coördination and coöperation.

My principal objection to military drill is that it does not fulfil the functions of a good exercise, as we are taught to understand them. In the first place, it is not of sufficient interest in itself to arouse enthusiasm on the part of the young man for his own physical development. The exercise of the manual itself does not give that energetic, active movement to the muscles which is necessary in order to secure their best development. It is essentially a one-sided exercise, bringing into action the elevators of the scapulæ, deltoid, trapezius, the biceps and the flexors of the arm, wrist, and hand on one side. It does not increase the circulation and respiration to a sufficient extent to develop the heart and lungs. During the drill the clothing is usually buttoned tightly around the body, therefore interfering with the natural circulation and respiration. The muscles are not alternately contracted and relaxed, but are tetanized; that is, are held in a strained position. This not only impairs the tone of the muscle, but also the tone of the brain and nervous system, at a time when they should be relieved from all tension. Finally, the mere exercise of the drill does not engage the coöperation and coördination of the muscles enough to bring into action the central nervous system. Coolness, courage, presence of mind, and that responsible and rapid exercise of judgment which is developed so admirably in the practice of athletic sports, and which is so important to a man of business as well as to a soldier, are not developed by the practice of military drill itself.

I am prepared to admit, however, that other very desirable qualities, such as obedience, patience, fortitude, and forbearance, may be brought to a very high degree of perfection under the military drill.

The community at large has long labored under the impression that there was something about military drill that assisted to make the figure erect and to give a graceful and manly bearing. Now I am prepared to maintain that military drill itself tends to make one stiff and angular in his movements and to droop the shoulders. This fact has long been recognized throughout the civilized world. There is a set of calisthenics or free gymnastics incorporated into nearly every treatise on military science, in order to meet this objection. Upton, in his old "Military Tactics," as you know, states that the setting-up drill, as it is termed, is indispensable, and that it must be frequently recurred to, and that soldiers must be frequently exercised therein. The "New Tactics" allows more freedom of movement to the individual soldier, yet three times the amount of gymnastics are introduced as in the "Old Tactics." In this connection it may be interesting to note that Mr. Koehler, who is one of our members, has, by the authority of the secretary of war, prepared a manual of physical exercises to be used in the United States army. Colonel Fox, of the British army, has also gotten out a manual, which is used in that organization.

In regard to neatness and trimness of figure, I would say that there are easier methods of attaining this admirable form of swell front, large chest, square shoulders, and straight back. One of these is familiarly termed tailorizing. It is said on pretty good authority, that in some of our private military schools the feminine corset has actually been known to encircle the manly figure and support the manly bust, and I think this modern coat of armor may add considerably to the neatness of form and trimness of figure which our lady friends so much admire. It is hardly as enduring as the figure that would be acquired by the systematic practice of gymnastic exercises and free movements which were incorporated in the very manual from which are taken the military drills for our youth. As for gracefulness, a young man will acquire more grace by putting himself one hour a week in the hands of a dancing master than by working under a drill master for one hour a day for an equal length of time.

In answer to some of my criticisms it may be said that we have military drill in normal schools for physical training. Well, we do have something which we term military drill; but this embraces simply the formation of companies and of squads for the purpose of practising facing and marching, and we have adopted the United States system in order to have uniformity in our regulations and commands. We also use military drill as an exercise in motor response to repeated commands, thereby carrying out the suggestions which Dr. Fitz has made here this morning in regard to practice in reaction time. I am perfectly free to admit that I think every educated man ought to be able to drill a mass of men. One of the functions of the gymnasium teacher sometimes is to guide large bodies, to marshal them in exhibitions and things of that kind, and it is that part of military drill which I consider of value. But if, in connection with this military drill, some one should have the temerity to come into the gymnasium and introduce a wand drill in which the movements were restricted to the same sort of exercises as are prescribed in the manual of arms, and claim that those movements were the best possible for developing the body harmoniously and uniformly, I think this individual might be allowed to depart, and perhaps to die, in peace, but I feel quite sure that no gymnastic teacher would strew flowers on his grave or write epitaphs commendatory of his intelligence. No, my friends, if we were called upon to-day to prescribe the best sort of exercise, not only to make the student a citizen but to make him a soldier, the last exercise that we should resort to is the manual of arms, to bring a man to the best physical condition either to be a possible defender of his country or to actually meet the exigencies of war.

If I were asked to make a prescription of exercise for such an individual, the first thing I should do would be to instill into his mind that the weapon he was expected to carry was not simply to be put through the manual of arms, but it was a weapon with which to kill; and that "To the Right Shoulder Carry!" and the other manipulations were not especially devised for his physical improvement, but simply to enable him to change his position in order to bear the weariness and monotony of his burden, and to accommodate himself as an individual to the action of others.

Were any further comments or arguments necessary in order to

show the fallacy of this movement in our schools, I might refer, for instance, to the establishment at West Point and Annapolis of gymnasiums and putting gymnastic instructors in command of them. I might also refer you to the admirable essay presented before this Association in 1891, by Col. Charles R. Greenleaf, M. D., of the United States army, in which he advocated the introduction of gymnasiums and gymnastics for the regular army. It will be remembered that at that time he was assistant surgeon-general of the United States army, and knew whereof he spoke. If still further evidence were needed, I would call your attention to the fact that in European countries where they are really trying to establish a nation of soldiers, they have learned by experience to develop the boy into an all-round man, by systematic gymnastic work, before they undertake to make him a soldier.

If, then, it is admitted that gymnastic training is necessary to give a man the exercise that he needs to make him a soldier, I say why, in the name of all that is reasonable, should we give a young boy military drill in order to make him a good citizen!

Dr. Arnold.—I am here as a delegate to your convention from the North American Gymnastic Union. I speak so much the more against this new movement, because our organization all over the country has seen fit to enter vigorous protest against it, wherever they have had a chance. We base our protest on the grounds which have been covered by Dr. Sargent.

I shall be guided by the results of history, as Captain Boyer was by the result of his experiments. Why not profit by other people's experience? In Germany, some ten years ago, I think a similar movement sprung up, perhaps as a result of the war of 1871, and we all had uniforms and guns and marched to make good soldiers. To-day the thing has been dropped; it is hopelessly lost, the experiment has been an utter failure. Why shall we not be guided by the experience of that country? Why again spend in this experiment millions of dollars, which I have no doubt it will cost if carried on—those same millions that we have been clamoring for these fifteen or twenty years in order to introduce physical education, and which we have not been able to get, and which we will not get if this movement takes a hold? It will kill the movement for physical culture if

carried. Who are at the head of it? Some ten or fifteen governors. I have a very high regard for some governors, but when a governor undertakes to say what is good for a school, by what right does he speak? I have seen some governors who were nothing but ward politicians at some time in their career. What right has such a man to say that this is a thing for primary schools? But when a lot of governors get together and publicly advocate such a movement as this, of course the danger becomes the greater to our cause.

Nor is the German experiment the only one which can be instanced. The French would not fall short of our attempt at making soldiers in 1871, and they tried just the same policy on their side of the Rhine. They spent their millions foolishly; what are they doing to-day? They are trying to introduce a system of physical culture nowadays into their schools. Two countries have foolishly spent their time and money for nothing, and we are going to be the next to emulate them.

Captain Boyer says that it does not infringe upon the school time. That is good. Nor would gymnastics interfere with the curriculum, if they were carried on as in Germany, where I went to school. We had to take gymnastics after school hours.

Captain Boyer says that it has happened that the best soldier had the best scholastic standing. That does not prove anything; it is a mere incident. At Harvard it has happened time and time again that the foot-ball men have had the highest standing in any year; yet educators of such high standing as President Eliot are trying to put down foot-ball.

Captain Boyer says that military drill will insure graceful carriage. Dr. Sargent has dwelt upon the physical side of that question. One can only pay attention to one thing at one time. If now a command is given the whole attention will be paid to that command. No attention can be paid to the carriage, and my experience is, that as soon as I give military drill I have to give these commands: Heads up! Shoulders back! Bring your chest out! I remember the officers in the German army giving the same commands. That proves to my mind that whatever improvement is made is not from the drill, but from extra admonition.

It is claimed that every muscle is developed in military drill. By what? The manual of arms has been disposed of by Dr. Sargent.

Outside of that there is walking and marching, in military work. The marching, if done in the ordinary way, is of no physical value whatever. Walking, as usually executed, is not a physical exercise at all. If it were, letter carriers ought to have tremendous muscular development of the legs. You will find that they are very poor in muscle, because they do not do the muscular walking that we call for in the gymnasium marching.

We are told that it makes a soldier who may be of use in time of need. This would be very laudable, no doubt. Should we teach school children, who have no understanding as yet of the relations of their country to other countries, the moral idea that only where the red, white, and blue floats are to be found good people; that all outsiders are enemies to our best interests? Is that an idea that ought to be propagated at the end of the nineteenth century? I think not.

Again, it is claimed that military drill makes men courageous, makes them good soldiers. Again let us be guided by the best experience. A few years before the gymnastic movement in Germany set in, at the beginning of the century, the Prussian army was the best drilled, best fed army, most neat, could march the best; and when the French came they ran the nicest and swiftest. It seemed it was the only faculty that had been fully developed. And what was the saving? Who put Napoleon out of Germany and drove the French back over the Rhine? Mainly Jahn and his gymnastic followers.

As far as the moral side of the question is concerned may I call to your mind the standard of morals of Europe at the time of the Thirty Years War, a time when every man and every country of Europe was at war? If you draw a picture of that period clearly in your mind you will have the effect of playing war, and I think that ought to be enough for any man.

Supt. E. P. Seaver, of Boston.—I am only a guest here to-day, an outsider, but I want to extend the right hand of fellowship to my friend who read the paper. I would like to say to you, representatives of physical training, that those who are interested in military drill are not trying to crowd you off your ground or out of your field. I come from a part of the country where military drill has been in the public schools for nearly thirty years, and it has not injured the schools seriously; on the contrary, it has done

them a great deal of good. I can be as dogmatic as my friend who read the paper, and say, *I know it*. I had charge of a large boys' high school for six years. Having gone into that school with all the prepossessions against military drill which my friend, Dr. Sargent, has expressed, I became a convert to the opposite view, not because it covers the whole ground of physical training, nor because it is the best possible form of physical training; but because, while it does something in this direction and does it effectually, it gives the boys an interesting and valuable thing to do—a thing which they, at least, believe to be highly valuable,—thus keeping them steadily under the operation of strong motives to do well. Having seen boys year after year entering the high school from the grammar schools, with their slouching, stooping, crooked forms and gait; having seen them straighten up and acquire a good style of walking in consequence of their drill in marching; having seen all this, I want to give my endorsement to military drills in school.

For a moment let me call attention to the circumstances under which military drill was introduced into the schools of Boston. It was not long after the Civil War. The leading men of city and state saw that there was nothing that could be depended upon to lead the boys into the militia. I think the introduction of military drill into our schools has done more than any one factor to recruit, and to recruit in a desirable way, the militia of the state of Massachusetts. Talk about the failure of the experiment in Germany! The United States is not Germany. If I lived under a form of government which required every young man to give three years of hard work to preparation for the business of killing Frenchmen over the Rhine, I would not for a moment stand as an advocate for the introduction of military drill into the public schools. But it takes a little thought to see just where the difference between Germany and the United States comes in. In the former, men do things because the emperor says the things must be done. The people of the United States do things because they get together and agree to do the things that need to be done. The governor or president does not compel our young men to go into the army, or into the militia. Recruiting has got to be done in a voluntary way; you have got to interest young people, and there is no more complete organization for that purpose than is offered by the public schools.

One word I will add. I think that in New York city, if you undertake to put the military drill down pretty low in the grammar grades, so as to engage boys of eleven, ten, and nine years old, you will make a mistake. We tried that experiment nearly thirty years ago in Boston. We gave it up, and the military drill has ever since been confined to the high schools, and there it has been a success in many ways. In one word I will say, as principal of one of the large schools, I found the military organization of that school an instrument of great power in my hands, by which I could wield the whole school with great ease; and no principal of a school who is inexperienced in that respect can imagine the power that it will give him, if his school is properly organized on the military basis. There is a moral side of it which I might dwell upon, but there is no time. I thank you for your attention.

DR. HARTWELL.—I do not possess nearly so much of the military spirit as I did when I was boy and drilled in the Boston School Regiment. Superintendent Seaver says that military drill works good effects in high schools. That I believe from observation and experience. It fits the evolutionary state of the budding youth remarkably well. His clothes-sense is coming strongly to the front at the time when he takes most kindly to military drill, and his consciousness is easily reached through the glitter of gold lace and brass buttons and the authority to give commands to his fellows. The military spirit has played an important part in the evolution of men and society. It has its place, but it is only a stage in passing to higher and more civilized and intelligent ideals in society and in classes. In this country we live less in a military state than in an industrially organized state. While the effects of genuine military drill may be admitted to be of value for the youth of from sixteen to twenty years, it seems to me that it is out of place in the schooling of boys of eleven and twelve; and it is military drill for such boys that was proposed in the bill brought in at Albany this winter. This attempt to engraft military drill upon our public school system is no new thing. At the suggestion of the board of education, the Massachusetts legislature brought in two bills in 1863, to promote the introduction of military drill into all the schools of the state, for all the boys over twelve years of age. On sober second thought, though

they had passed two stages toward enactment, the bills were killed by remonstrants at the state house, and have never been reborn.

If this bill passes in New York, and is copied in other states, I think experience warrants our saying that the experiment will die; not still-born, perhaps, but from inanition and disgust within ten years. I believe it is absolute folly to attempt the military training of boys under fourteen years of age, under the conditions which obtain in our public schools. There is military training and military training. Organizing boys into squads and companies, or even regiments and brigades, for the sake of parading them about the streets, or to enable them to take part in prize drills, does not seem to me to be military training of the kind that should be encouraged.

Military drill, as generally practised in this country, has savored chiefly of parade ever since the Napoleonic tactics were made the standard in the United States by West Point early in the century. There is less of show in the genuine military tactics among the military nations of the world to-day than there was then. Our boys in Boston might just as well practise the manual of arms with broomsticks as with the guns they have. They do not know the mechanism of their guns; they never snap a cap.

Supt. Seaver.—Oh, yes, they do.

Dr. Hartwell.—They never load a cartridge; I doubt if they ever clean a gun as it should be cleaned. They cannot aim; they know nothing of the primary business of a soldier; they never learn to shoot. If this movement here in New York means improvement in markmanship; if it means the development of ability to march five to ten miles without straggling or tiring out; spending a week under canvas under military discipline, I bid it God-speed, for then it means military training, and not merely military drill. It is possible to be expert in parade tactics and yet know nothing of sound military training. The governors of some forty-seven states and territories are said to be in favor of the bastard military training proposed in the New York bill. They would do well to ponder on the history of previous movements of the kind which have failed both in this country and in Europe. Gen. John Knox, the first secretary of war of the United States, proposed an elaborate scheme

in 1790 for securing the military training of the youth of the country who were eighteen years of age and over. He could n't carry it! William Henry Harrison, in 1817, and again in 1819, brought forward in the national house of representatives a scheme for organizing a corps of military and gymnastic teachers to serve in the public schools throughout the country. He could n't carry it! Though his grandson favors the present scheme, it does not yet appear that he and his cohorts of comrades can carry it.

After the Franco-Prussian War, the French spent much money, time, and effort in organizing their school boys in *bataillons scolaires*, for the sake of military training and parade. It was done against the protest of their wariest and most experienced veterans, who said,—"Give us boys that have been well trained in gymnastics, and our drill sergeants and officers will soon enough make good soldiers out of them. We do not want to have to train extravagance and mistakes and wrong-headedness out of them to begin with." This experiment in France has ended in failure and disgust.

The military and educational leaders in Germany have never been willing to make military drill a part of the school curriculum for boys outside the cadet schools. Emperor William I, Moltke, or Emperor William II, never countenanced or promoted such *militarische spielerei*. Their pointed preference for gymnastics as the best form of bodily training for school boys who must later on serve in the army is highly significant.

Let us not delude ourselves with the notion that by appointing retired drill sergeants and pensioned veterans to help small boys and callow youth play at soldiering we should be introducing an adequate or effectual system of physical training. The thing has been tried in France and England, but with conspicuous ill success. It is bad pedagogy to put physical training into the hands of men so little fitted for teaching as are most old soldiers, if they are nothing but old soldiers or militiamen.

PRACTICAL PHYSICAL TRAINING IN PUBLIC SCHOOLS.

BY NETTIE D. KIMBERLIN OF DETROIT.

In this paper I intend briefly to give my idea of the place and aim of physical training in public schools, and to say something of the technique of physical directing under the conditions there presented. The subject is ideal in that it represents what seems to me the best standard, but practical in that the benefits claimed are such as I have already observed in my own experience and the method of working for these ends, the one in use in Detroit.

The subject divides itself naturally into two sections; first, that which deals with the pupil; second, that dealing with the public school teacher as the instrument in executing the physical director's instructions.

In the case of the pupil let us examine the conditions we have to meet. The average child of healthy parents probably leads a more nearly natural existence, between birth and five or six years of age, than at any other period of his life. He eats heartily and regularly, sleeps soundly, and plays vigorously; growth and tissue change are active, and the mental faculties, while developing, have not yet reached the point where they can overrule the physical entirely, as they so often do in later years. As a result, most children come to us healthy and vigorous, with fairly well-shaped bodies.

With school life new conditions arise. Mental training is begun, and the work and confinement together make up a life less near that of nature than the one hitherto led. Unfavorable modifications, more or less marked, must occur, and I think our main effort should be to counteract these; that is to say, our work is preservative rather than formative, as our object is not to develop athletes or strong men, but simply to continue healthy conditions for the child so that he shall grow up with a body strong and fit for the work of life, and so trained as to be the ready servant of his *will* under all circumstances and emergencies. The particular exercises that will best do this can scarcely be specified here; they must, however, be such as can be performed under present conditions of school life, and should aim primarily to develop sound heart and lungs, the essentials of physical vigor, and secondarily, secure bodily self-

control. Such exercises form the basis of the system, but leave a large field for military, flag, and musical drills, and other special exercises.

Quite as important as the exercises is instruction in physiology and the hygienic care of the body. In my own work a course of physiology is studied by all grades during the school year. The subject is presented in as practical form as can be done in the school-room. Charts are used, and in many cases the actual tissue.

The pupils not only have an intelligent appreciation of the subject, but in many cases the teaching has produced practical results outside of the school by changes in dress, food, and mode of life. This part of the work, aiming as it does to develop the body a sound and perfect instrument, is the first and most important duty in physical training.

But beyond this are important mental and moral results which should be carefully sought. To a large extent these secondary effects are incidental, but we should never be content to let them accrue in a purely accidental manner.

We by no means fulfil our duty when we have given the child sound heart and lungs and vigorous limbs. These things are good and worth striving for, but they form only a part; and we can never hope for all the good of physical training until we at all times apply to this branch of instruction the same methods of research and the same patient, thorough study, as has been given of late years to language studies and the mental development of child-life.

The most marked mental result is probably the increased power of doing good work, which we get by putting the body in a vigorous and healthy state,—a good instrument will naturally do more and better work than a poor one. There are certain specific benefits directly traceable to special sections and methods of the work. Among these I would place first the alertness, precision, and prompt execution of voluntary movements we obtain through *military execution* of the exercises. The exactness and rapidity of this form of movement have, too, a special value in developing concentrated attention, which, becoming a habit, must prove of use in the parallel development of the mental life. In this connection I would like to point out the influence of numbers in obtaining our results. A ready example occurs in the many cases in which panic will pass from man to man till a

whole crowd is mastered by a great fear. In the opposite direction the calmness, concentration, and self-control of one man or child will lend itself to his neighbor till the individual, moved by the strange, impalpable force of crowds, finds attention easy and disobedience difficult.

A noticeable mental elacticity and lightness may also be seen to follow the use of musical and flag drills. Intelligently used these have great value, especially in times of listlessness and restlessness among young children whose mental habits are as yet unformed.

In Detroit we have insisted upon a brief period of light exercises every twenty minutes for all primary grades, and it has resulted in a brightness and power of attention that fully proved its value.

Certain moral effects, too, follow systematic physical training. The first observed is the better discipline, prompter obedience, and, consequently, the greater ease with which the teacher can obtain perfect mass control of large bodies of children.

Going from the class to the individual we soon find a self-reliance and self-control which comes from a knowledge of his bodily powers and the assurance that he can use them at will.

I think, too, that the physical director may rightly teach some of the elementary forms of courtesy by showing the significance and use of the military salutes, and insisting upon their performance, both collectively and individually. There is a concreteness in these forms which seems to make them especially serviceable to this end, and I have often seen the plan work well.

The question of the further moral influence of systematic physical training opens a field in which our knowledge is somewhat vague. I think it reasonable to expect that perfection of physical condition must eradicate, or tend to eradicate, some morbid tendencies common among school children.

I have already spoken of the teaching of physiology and hygiene, and my last remark brings up the question of how far we may carry this instruction. In a recent discussion at the Twentieth Century Club of Detroit, a prominent physician of the city condemned all movements toward introducing physiology throughout public schools, on the ground that it would have an immoral, rather than a moral, effect.

Few, if any, here would exclude this subject, but how far we may

carry it is a difficult problem which we must face and answer soon if we accept the modern dictum, "Light is the best policeman."

So much for the end sought; we must next look at the relations of the physical director to the public school-teacher. In few cases can the physical director do all the work personally; he can simply direct and see that the teacher carries out the instructions. To do this it is not enough to see that the teacher directs the class to execute some movements previously memorized. The teacher must do that indeed, but he must do so understandingly, knowing fully the why and wherefore with a due appreciation of the close relation of physical training to the mental work of school.

For this purpose I would supplement instruction in the exercises by a regular series of grade-meeting talks with the teachers, starting with a brief outline of physiology as a basis from which to show the need of exercise and its influence on the human economy. Later these generalized statements become specialized and applied to each department of school work and, if need be, to individual teachers. I would then emphasize the need of keeping the principal point of the training in mind during the day.

A correct position for a few minutes during drill will do little to correct a slouchy posture, tolerated until it becomes habitual. Correct sitting and standing positions are to be insisted upon during recitation periods, and the orderliness, precision, and respectful salutes of military drills preserved in all mass movements.

As they grow familiar with the work, the teachers should be shown the need of watching the weaker children, excusing them at times, and modifying the work to suit their powers.

Statistics show that one in fifteen school children has physical defects marked enough to call for attention.

It is difficult to get the teacher to see the need of all this at first, and it can be done only by a presentation of the work that appeals to his reason, that is, by showing physical training to be the basis of all lasting endeavor in other directions and applying to it the pedagogical methods of mental training.

In conclusion, I would like to speak of some points that need our immediate attention.

First comes the question of the proper treatment of the deformed, and all who, not wholly incapacitated from effort and the chance of

benefit from the physical training, are yet unable to take the ordinary class work. More than others they need our careful and considerate attention, yet they cannot receive this under present school conditions without unfairly holding the others back. School boards have already established special schools for the deaf and dumb, and I think a like movement would probably meet the other case.

Next comes the question of school play-grounds. Our school children show little of the spontaneous activity natural to childhood, and, too often, the impulse to play has to give way for want of proper play-grounds.

In England every school has a play-ground surrounding it,—often quite an extensive one. In many cities these are opened evenings and Saturdays, and in some of the crowded manufacturing and slum districts other grounds have been reserved—not ornamental parks, or so-called breathing spaces,—but veritable play-grounds, where children can romp or play ball to their heart's content. England has long been known as the country of popular athletics, and, no doubt, much of her great commercial and political power may be traced to the vigorous constitutions developed in the school play-grounds.

The lesson is worth learning. Systematic physical training can do much, but it cannot do all, and it should never be allowed wholly to replace the natural activity of vigorous out-door games.

One danger to be carefully guarded against is a tendency to limit our work to one system. No one system meets every case, for, while there is "Good in all, but not all of good in any," we should keep ourselves elastic enough to seize the good that may be in any new idea. At the same time I hold it very necessary to use these new ideas only after rigid tests in the light of our own surroundings, especially in regard to suggestions coming from different climates and conditions of life, as our American environment has produced a distinctive American type.

The last point is the need of placing this work in the hands of expert physical directors. Public school physical training is rarely successful without such direction. Too often the teachers perform exercises merely because the order has gone forth that they shall exercise, tolerate it as a fad, and go through it as a nuisance. To be

worth anything the training must be thorough, systematic, and intelligent and it can be so, fully, only in the hands of experts.

Therefore, I feel that we should press the need of special physical directors everywhere, in village, city, county, and state, and we can gain this point only by patient, earnest work within our present limits till people have learned that physical training is not a mere passing fad, but a necessity of modern conditions, and an essential part of education to be got, if need be, even at the cost of many things now more highly esteemed.

DISCUSSION.

MRS. MARGARET STANTON LAWRENCE.—I am not going to start a discussion on this paper, because I want to say a few words before I am obliged to go away this afternoon. I am sure the Association will all be very much interested in the new departure that has been taken by the Teachers' college.

This college is given to adopting new methods that prove themselves good. We have a very energetic corps of professors and teachers, from our president down, who are willing to try experiments. Last fall I insisted that every pupil who took gymnastic exercise should be examined by a graduated physician. It did not make any difference what gymnastic exercises they took, they all had to pass this physical examination. The physicians in charge had these papers made out, as they wanted to keep them on file. Each child took them home and had them filled out by their parents, and I had similar ones made for myself.* This year the faculty have come to the conclusion that they want to know as much about the physical condition of their pupils as I do, so we have decided that hereafter every person who wishes to take a teacher's course must send us a certificate from some well-known physician, saying that this individual is in proper physical condition to undertake the work. We maintain that if you raise the standard of health for men and women teachers, the men and women teachers will come up to that point, and we have decided that the teachers who go out from this college must be thus equipped. I think there are no other institutions of learning in America which require this, with the exception

*Here Mrs. Lawrence showed the examination papers and cards in use at the Teachers' college.

of West Point and Annapolis, and the training schools for nurses. I said that last fall we insisted upon an examination of every pupil that came into our school, so that all the little children you saw to-day had been thoroughly examined, and those who were not in a fit condition were excused.

One word to gymnastic teachers,—the women teachers before me. I have been trying ever since I have been connected with the Teachers' college, to get the girls to dress hygienically. There is a very fashionable school on the Hudson river, where the girls pay anywhere from $1,000 to $1,200 a year for their tuition, and no girl is allowed to wear corsets during school hours, and the dress skirts are four inches from the ground. We have been trying, and I hope we may accomplish it, to establish this among our own girls. Last Saturday we had a kindergarten conference here. Training teachers came from Pratt Institute, Normal college, and various other schools. I called all my kindergarten pupils together, and said, "Now, girls, I do hope that on your public exhibition day"—they were going to play their games—"every one of you that has had anything to do with me will appear for your games in loose dresses, and no corsets, so that you can do your bending and jumping and running without the slightest injury." And they did so. Right here I want to urge all gymnastic teachers of women to buy one of these sets of organs [showing cloth model of visceral organs, devised by Dr. Mosher.] When I first got them I asked my girls how long they supposed these internal organs were? One very intelligent girl—intelligent in other directions—said she thought about two inches. Another one thought they might be two feet. But when I showed this model to them, it really opened their eyes. I said, "How are you going to dress as you do now, laced up in tight corsets, without doing injury to yourselves?" So I would advise each of you teachers to invest in a full set of these organs. I am sure you will make much more impression upon your girls.

Dr. Seaver.—I am sure that all the friends of Dr. Mosher—and that includes every one here, whether personally acquainted with her or not—will recognize the origin of these so-called organs.

THE PHYSICAL ELEMENT IN EDUCATION.

BY PROF. E. L. RICHARDS OF YALE UNIVERSITY.

It would be as unwise as it is impossible to expect that every person engaged in education should be able to survey the whole field. Each educator takes a part, and is very apt to think, if he or she is in earnest, that his or her part is the most important part. Education, until quite recently, has been so widely regarded as brain culture, that the whole trend of education is to develop the mind as one organ of the body, as if mind resided in the brain alone. And even those who know and admit that the mind is something more than brain, disregard the fact in their systems of education following almost unconsciously the old ruts. Thus Bain says, in one place: "The organ of mind is not the brain itself; it is the brain, nerves, muscles, organs of sense and viscera." And yet in "Education as a Science," he says: "Now when we inquire into the meaning of physical education, we find it to be the rearing of a healthy human being by all the arts and devices of nursing, feeding, clothing, and general regimen." Mill includes this subject in his article, and Mr. Herbert Spencer devotes a very interesting chapter to it in his work on education. It seems to me, however, that this department may be kept quite separate, important though it be. It does not at all depend upon the principles and considerations that the educator properly called has in view in the carrying on of his work. The discussion on this subject does not in any way help us in educational matters as most commonly understood, nor does it derive any illumination from being placed side by side with the arts of the "recognized" teacher. And we have seen a committee of ten of the "recognized" teachers of our own land blocking out the time of the secondary schools without a single word of reference to the important matter of physical education.

The committee of fifteen, which lately met at Cleveland, Ohio, in their voluminous report on education, did devote one short paragraph to physical culture. But they did not seem to grasp the vital connection between the growth of the mind, and the development of the body. For they remark, that "systematic physical training has for its object rather the will training than recreation," and again,

"systematic physical exercise has its sufficient reason in its aid to a graceful use of the limbs, its development of muscles that are left unused, or rudimentary, unless called forth by special training, and for the help it gives to the teacher in the way of school discipline." The report makes physical culture subsidiary to other kinds of education, not as it should be considered, a *fundamental* and *necessary* part of education.

I have therefore thought that a few remarks on the physical element in education would be timely.

It is a suggestive fact that the ratio by weight of the brain to the body of a new-born infant is one to ten, while the ratio of the brain to the body of the average European adult man is one to forty-six. Does not this fact at the very outset of life point the way to a correct education? The body needs development till it attains maturity, if it is to have its appropriate growth. The brain needs care rather than special culture while the body is developing rapidly. Its *appropriate* culture for the years of growth is to be found in its supervision, direction, and control of the body.

If I were asked what should be the prime essential result of a man's education, I should say power, vigor. And by that I mean that a rightly educated man should have force in himself, of which he is master. And I do not hesitate to say that any education, however well it stores the mind with ideas or fills it with knowledge, and yet fails to cultivate this force, is so far a failure. I would extend my remarks so as to include similar statements about the education of woman. Her power may be of a different kind, but power she needs for the battle of life just as much as man needs his force. And until we educate our men rightly, and our women also to be in this respect real helpmeets to men, we shall not have on this continent a race which is to remain. What Dr. Clark says in the "Building of a Brain" may well be quoted here: "On this continent races have been born and lived and disappeared. Mounds at the West, vestiges in Florida, and traces elsewhere, proclaim at least two distinct races. The causes of their disappearance are undiscovered. We only know they are gone. The Indian, whom our ancestors confronted, was losing his hold on the continent when the *Mayflower* anchored in Plymouth Bay, and is now also rapidly disappearing. It remains to be seen if the Anglo-Saxon race, which

has ventured upon a continent that has proved the tomb of antecedent races, can be more fortunate than they in maintaining a permanent grasp upon this Western world."

How shall we develop this power? Regarding the new-born child as a bundle of latent forces, how shall we draw them out so as to be active, directed and controlled in the charge of an enlightened will? Only general suggestions can be offered. In the first place, the order of development is important. The first attention is necessarily given to the physical powers. Nutrition is the first want, next comes motion, the exercise of muscles, and through these a certain development of mind and will. And these phenomena of motion on the part of children are so common-place, and when we wish them to be quiet, so exasperating to us, that we miss their great importance in development. How can children grow without continual motion? Just consider how large a part of our physical economy is dependent on motion. We pour food into the stomach, but the stomach is a muscular organ and does a great part of its work through muscular motion. It is to a certain extent dependent for its tone on the vigor of the muscular system. After the food is converted into chyle and sent drop by drop into the blood, and then passed through the oxygenizing process in the lungs, what is it that pumps it along the arteries but another muscular organ, the heart? And how much help this flow of nutritious blood to the very extremities of the system, into every nook and cranny of every organ of the body, derives from the action of the voluntary muscular system, we can hardly estimate. But we know the life current is quickened by exercise, and slackened by the cessation of exercise. There is another way in which we know the influence of the voluntary muscular system. When more exercise is taken more food is required to repair the waste, and there is better circulation of the blood.

Again, consider the senses, those avenues of knowledge to the knowing mind. Take the eye. It is not only a combination of lenses with a retina behind them sensitive to impressions. The lenses are furnished with adjusting muscles. And the ball itself is fitted with other muscles to roll it in the socket and to direct it on objects which the will commands it to see. Then, too, there is the

sense of touch, which with sight gives us knowledge of the outside world. How could it give us such complete information of our environment were it not supplemented by the muscles of the outstretched arm and the feeling hand? Our hearing is better because we have muscles to enable us to turn the head that we may listen. Smell and taste are more efficient because they are supplemented by muscles appropriate to their functions.

Then if we take our social life, how large a part of it is dependent on speech. And speech itself would be impossible without the muscular power of taking and expelling breath, and the movement of the muscles of the larnyx. Without muscles the hand of the writer could not write our books any more than the cunning hand of the artificer could work out the inventions of this inventive age. Knowledge itself then is dependent on muscles, and the power of muscles on motion.

A wise provision of nature is it, therefore, which implants in children a desire for play. By the very instincts of their nature they seek motion and the exercise and growth of their bodies through motion.

But do the good effects of exercise end in the body? Is that simply larger and stronger? The mind, too, has its share of good. In the first place, the brain and nervous system are supplied with blood and more of it. The repair of the waste is more completely made. This of itself is one great gain. But in all use of the voluntary muscles there is, as the term implies, a necessary putting forth of will and mind. The mind is exercised while the body works. And this is specially true in all exercises which require skill, where the mind has an object to gain through the skillful use of the body. This mental element comes in very early in a child's life, as for instance, in learning to walk or learning to swim or to write. All through the years of childhood it accompanies motions in games, most mind being required in those games which require most skill. So those gymnastic exercises which call for combinations of muscles in action, and need quickness and exactness, are more useful for the majority of children and men than those requiring the use of strength alone. For to attain success in games or exercises of skill, not only quickness of body is needed but an alertness of mind and often, too, quickness of the senses of sight

and hearing. This mental element in certain athletic games explains in a measure their fascination. They furnish an exercise not for the body alone, but for the whole man, every part of his nature including his mind, his social nature, and even his moral nature being brought into play. This is particularly the case, in a game in which a number of players are involved so that individual skill must be subordinated to the good of the whole body of players. The individual must repress and control self and observe law. Children have the same discipline in their play when they engage in games requiring the observance of rules.

This mental element in games perhaps will assign their place as the first in any rational system of physical culture. The grind of the gymnasium is so distasteful to the generality of mankind, that gymnastic exercise, whether free or with apparatus, is only sought as a last resort. But gymnasium work can be made interesting by variety and by competitions. By being made also a preparatory training for athletic sports gymnastic exercises can be given an interest and a power which they would fail to possess if taken only from a sense of duty.

The more complete the exercise is for the whole system, the more complete is this development of the mind through the body. Therefore all supervision of the exercise of children should be in the line of removing obstacles to the free exercise of every muscle of the body. Care should be used to guard against the compression of any part of the body by tight clothing. Badly fitting, uncomfortable shoes often make the movements of the feet and lower limbs a torture, affecting unfortunately the carriage of the whole person and necessitating ungraceful habits of walking.

The connection between the body and mind is so close that the working of every (even the smallest) muscle of the body must leave some trace in the mind. The education of the mind through the body is defective to the extent of every unused muscle. We see this plainly according to Dr. Luys, quoted by Dr. Faries in his paper read last April, when a limb has lost its function there is atrophy of certain parts of the gray matter of the brain, due to defective action of the motor cells.

The brain has a great deal of its development from its office of directing and controlling the use of the body through the muscular

system. The more extensive this use of the muscles, the more complete the education. Interfere with this education by directing the will too early in life to conscious cerebration by means of books and you not only check the development of the brain, but you deprive it also of an education more important than knowledge can give it, and one which no subsequent effort can supply.

In support of this theory of the growth of mind and true brain power during the period of immaturity through the muscular system, I quote from Dr. Ladd's work on Psychology: "All our study, hitherto, has led us to emphasize greatly the influence upon mental development of the constitution and functions of the muscular system. The condition and action of the muscles stand in reciprocal relation to the senses and to the feelings which form the necessary effective accompaniment of the senses. Furthermore, the striated (or so-called voluntary) muscles are organs of the will. In the complicated sensori-motor apparatus all the most primary foundations of the intellectual life are laid."

This quotation is right in line with the fact that the first development of will comes through exercise of the muscles, for the first development of will like all succeeding development of will consists in overcoming resistance, and the first resistance to be overcome is physical. The child with flabby muscles has generally a defective will power. Men of strong physique have strong will power. Of course this will power to be effective must be educated and directed like any other power. But its foundation is laid in bodily powers.

Another confirmation of the necessary connection between strength of body and power of mind is to be found in the history of the dominant races. The Greeks afforded the finest types of body of their times, or of any succeeding times. They showed also that their intellectual activity was as remarkable as their physical development. They have also produced a literature that will never die. The Roman power which lasted longer than the Greek dominion was founded on physical prowess. They also have left a law and a literature which are imperishable. The Northern races of Europe overcoming the Roman arms by sheer physical force and appropriating what was best in the Roman polity, became the masters of the world. From these, one more virile than the rest, the Saxon, now become the

Anglo-Saxon, is through its descendants almost master of the present world. Moreover, all those races when they declined, went down before races of stronger physical power. The corruption of the body by sloth and effeminate luxury was followed by a mental decline just as softness and weakness of mind and will have always gone hand in hand with enervated, enfeebled bodies.

But I should be misunderstood if I left the impression that muscular force is the only force to be considered. Even of the bodily forces, or of the agents which go to make these forces, it is only one, though one of the most important. Nutrition must be attended to. Without perfect nutrition the best muscular force is impossible. If nutrition is faulty muscular exercise if long continued does harm rather than good. Next in importance to nutrition is a fresh supply of oxygen to make good, pure blood. Exercise should be taken in the open air, or at least in the purest air possible. The skin should not be neglected. In fact, all the laws of hygiene should be observed. Tests and measurements should be made of every person to determine the best kinds of exercise for that particular person. And these examinations ought to be made by a thoroughly educated physician. It will not do to trust such an important agent in education as physical culture to a man or woman who only has a smattering of knowledge.

Systems of exercise are not half as important as the person who exercises. Systems are only important in what they can do for that person. The systems studied apart from the individual may be perfect. Applied without judgment to particular individuals they may prove disastrous failures. The persons exercising must be studied first, last, and all the time, next their environment, and then the kinds of exercise suited to their condition and needs.

INFLUENCE OF PHYSICAL TRAINING ON SCHOOL LIFE.

BY E. P. SEAVER, SUPERINTENDENT OF BOSTON PUBLIC SCHOOLS.

I might take the last remark, well made by Professor Richards, for my text. We speak of the spirit, and of the mind, and of the body. But why? Merely for convenience of expression. The

structure of our language is such that we are obliged to resort to such forms to make our meaning clear. But when we think closely, we see that there is no spirit without mind, no spirit nor mind without body; and that these are so commingled that we cannot influence one without at the same time influencing the other, either in growth or in activity.

Now I take it that the particular work which I am to speak of is, in its fundamental analysis, simply an effort to adapt our school work to the child in such a way that the whole nature of the child may be touched in all parts. It is traditional, unfortunately, with our teachers, that the sole business of the school is to store the mind with knowledge. Or, stating it in a little larger way, to train the mind, develop its mental powers. But only a second thought, or no thought at all, is given to the physical part of the problem, as our school work commonly goes. Even the extract from Professor Bain—a progressive educator, as educators go—read by Professor Richards, shows how an intelligent man sometimes sets the matter of physical training off to one side. He has nothing to do with it as an educator; it is something apart; it is something floating midway between the jurisdiction of the schoolmaster and that of the family physician, and he does not exactly place it anywhere.

I am rather surprised at myself for venturing to speak in a meeting of experts, and thereby inevitably disclosing my own ignorance of your special line of work. I can only look upon physical training in the schools from an outsider's point of view, and when I consented to appear and say a few words, it was with the idea that perhaps something which I had observed, from an outside point of view, might be of interest to you. I shall make no apology for quoting Boston and the schools of Boston, because my field of observation has been strictly limited to the schools of that city and of the immediate neighborhood. I shall try to state to you, in a few words, the impressions that I have derived from the observation of the physical training now going on in the schools of Boston, under the direction of Dr. Hartwell.

I may say that, prior to five or six years ago, our schools had so-called physical exercises. They were exercises of a sort not unknown, I suppose, to the schools in many parts of the country, a series of memorized exercises, done usually in cadence, with the

accompaniment of music, lacking in precision, the arms rising and falling with an indefinite undulatory movement. I have often heard the epithet "flopping" applied to them, and this epithet is picturesque. To be sure, exercises of this kind were useful for purposes of show. I well remember a school-master some twenty years ago, who drilled his boys to perfection in this old-fashioned kind of physical exercise, and went about the country showing what his boys could do. He went to teachers' conventions and meetings of all sorts, winning great applause. A good deal of interest was excited, and as one consequence a standing rule was adopted by the school board of Boston to the effect that, at a given hour in the forenoon, all work should cease, and scholars throughout the building should indulge in these exercises. By personal observation, I may say that, for the most part, these exercises were performed by the teachers in a perfunctory manner, and that they were wholly lacking in interest for the scholars. The only thing that could be said in their favor was that they furnished a little break in the steady grind of book work, and gave an opportunity for dropping the windows and admitting a little fresh air into the school-room, for the methods of ventilation in our Boston school-houses are not perfect yet. Many a time have I found exercises of this description performed in a loose way, and not infrequently have I found they were dropped out of the teacher's programme altogether; for if the teacher felt a little in a hurry, wanted to gain time for a little more book work, the first thing on the programme to be crowded out was the so-called physical exercises. That pretty fairly describes the condition of things only five or six years ago. Then some enterprising people, interested in public education, determined that the Ling system of school gymnastics should be introduced into the schools of the city. The first step was to open a gymnasium and to place the school-masters and some of their assistants under training. The masters of the schools very soon learned there was something in it. As they said, it made their bones crack; some of them were above the age of fifty, and had neglected physical exercise many years, and they found that in the Ling system of gymnastics there was something that took hold of them, took hold of their muscles, and I suspect of their joints, too, a little, for they described their feelings the next day in terms which left no doubt on

the point. However, it had the desired effect of producing the impression that there was virtue in the exercises. The next step was to place under training the largest practicable number of teachers. All this was done before any attempt was made on a large scale in the schools. At first only a few schools were experimented with; but when all things were ready, the introduction of the Ling exercises was made obligatory throughout all the schools of the city.

Now I have noted down two or three points which may be taken as the result of the experience we have had during the last five or six years in Boston. I will give you simply the result of my personal observation, and will not undertake to generalize:

I have observed, first, the children like it. In order to test this, I went a few days ago into a girls' grammar school. I reached the school about quarter past eleven. The girls had been at work with their books, except for a short recess, from 9 o'clock until that time, two hours. They were members of the first class, the upper or graduating class. They looked a little tired and jaded. I said to the teacher, "I have come in this morning because I would like to see what the girls can do in the way of physical exercise." Heads up, and eyes bright at once. They were glad indeed to take a turn at the exercises. They marched out into the hall, went through one of Dr. Enebuske's day's orders, beginning with gentle movements, coming gradually on to the larger and stronger movements, reaching the fortissimo, and then through a diminuendo to the end. I saw towards the end what five minutes of exercise in that way had done for those girls. It had thoroughly engaged their lungs and their circulatory organs, for I could see the evidence of it on their faces. I have no doubt that when they went back into their room they did more and better work in the remainder of the school session than they would have done had I not interrupted them in the way I did. Now what I want to see is an interval for exercise, or intervals for exercise, in every room in every schoolhouse throughout the city. Dr. Hartwell spoke of the short allowance of time, sixteen minutes a day. I agree with him in thinking it ought to be longer, but not very much longer—that it can be divided into short periods, and that the effect of those short periods of exercise would be invaluable to all the girls and all the boys. I find that the children like it because there is effort in it, precision

and point in the movements, which the children take delight in doing to the utmost degree of perfection. That floppiness of the old exercise has completely disappeared. There is no effort in lazily extending the arm in that way (illustrating), but when it is to be extended to the utmost reach in precisely the right way there is effort, and in that last inch comes the whole value of the movement, I suppose. I don't speak as an expert, or as one having authority.

Now what was the effect on the teachers? I inquired pretty carefully into that. Very soon after the teachers began to take these exercises in their classes many of them said, "My head aches much less frequently;" "I have a better appetite;" "I eat more for luncheon;" "I am more inclined to take exercise in the fresh air and less inclined to drink tea." Now that last, in itself, is worth a good deal to the children, for if there is any unlovely thing in a school-room, it is a teacher whose nerves have been unstrung by indulgence in the drinking of tea. The effect shows itself statistically by counting up the number of leaves of absence that had to be asked for by the teachers on account of weariness; the number of leaves of absence has decreased decidedly.

Now in speaking of the boys, I may come upon the ground of military drill. As I said this morning, our grammar school boys are not given the military drill at all. A few years ago Dr. Sargent did a very good piece of work for us by pointing out that the military drill which we have in the high schools was having a deleterious effect upon the forms and the carriage of the boys. He was in the best possible position to find out that, because he put every student admitted to Harvard College through physical examination, and a good many of his students had been boys in the Boston high schools, where they had taken the military drill. Some ten or twelve years ago he called my attention to the fact that the boys who came from the Boston high schools were distinguished from the boys coming from other parts of the country by a certain elevation of the right shoulder, a malformation accompanied by a little crooking of the spine, and he stated that, in his opinion, the military drill alone was responsible for this malformation. He thought attention ought to be given to the question of providing the proper remedies. We took his warning, and we have corrected, we think,

thoroughly and efficiently, the bad tendencies of the military drill by introducing gymnastic exercises—setting up exercises they are called—designed to accomplish that end. In support of this statement, I have a bit of testimony from the instructor in military drill, who says that since the introduction of the Ling gymnastics in the grammar grades the boys have come forward to the high schools in very much better form. I, myself, remember how it was from fifteen to twenty years ago, boys coming from the grammar schools stooping, crooked, lop-sided, shuffling in their gait, pale and flabby in countenance. This description fitted a good many more boys than it was pleasant to count. Since the introduction of the Ling gymnastics there has been a distinct diminution of that type of boy. They show more blood in their faces; they walk as if they had a good right on the earth. The improvement is indeed striking.

But the girls. "What is the effect upon the girls?" I have asked over and over again of the teachers. And the answer has been, "The girls? Why, they have given up the wearing of corsets." In the class of girls I spoke of a moment ago, I saw just one girl, when they were performing the deep stooping movements of the day's order, who gave unquestionable evidence of wearing corsets. She was a colored girl, and ambitious of becoming a lady according to her way of looking at things, probably. The use of corsets, so the teachers of the school tell me, has been completely, or almost completely, discontinued in that school. It is so in all the girls' schools. The master of this school told me that five or six years ago it was not an infrequent occurrence for him to be sent for in haste to come to a school-room because a girl had fainted; but he has not had a fainting girl in his school for the last four years, not one. Experience is the same in other schools.

So much for my own observations and experience. I will now turn to another matter. As physical training teachers, in charge of that department in connection with public schools, I suppose that you meet with the feeling, on the part of teachers and on the part of conservative people, that this physical training is a new fad calling for more time, that it is something that has got to be pushed into the course of study, something that will rob the other studies of their due share of time. But I think we want to make this point clear: that it is not a thing which will rob the other studies, but it

is the most promising thing we have found yet for helping all the other studies. I am perfectly willing to maintain this proposition, and to demonstrate it by the work of scholars in schools: Given a school with five hours daily session, with no physical exercises and no recess, according to a recent craze, on the one hand, and on the other hand a school with the same nominal length of session, but with ten or fifteen per cent. of its time given up to physical exercises, well chosen and well adapted to their purpose; given these two schools, and the second school provided with physical exercises, will excel the first school in quality and in quantity of book work,—excel them sufficiently to provide an ample offset for all the time devoted to physical exercise. I have not the least doubt of the truth of this proposition, for I find that where children are kept in good bodily condition, by properly adapted physical exercises, they do their mental work so much more thoroughly and quickly that really the physical exercises result in a gain of time instead of a loss.

I well remember in a certain school many years ago—and I was one of the pupils in the school—when two or three of us, just before the long recess in the middle of the forenoon, debated whether we would go into the hall, sit in our desks and review the lesson which had to be recited directly after recess, or whether we would go out upon the lawn and join in a smart game of foot-ball that was going on. I said then, "If we go and play foot-ball for fifteen minutes, our lesson will be so much better done when we come in that we shall not regret the apparent loss of time," and it was found to be so. I believe that that decision was the right one. I like the free play which was engaged in in the old-fashioned country academy, where we recited the morning lesson, and then had a couple of hours to divide between lessons and recreations, foot-ball, base-ball, and what not; then a recitation in the middle of the day, and a little more time which we could divide in similar manner; then a recitation and prayers at the close of the afternoon, after which we were free, in cold weather to go to the river and skate, or in warm weather to swim.

That leads me to say that probably the need of physical training is not so keenly felt in the country schools and academies as it is in our great city schools. Professor Richards said something which suggested a question, whether the Anglo-Saxon race was

destined to continue on this continent, or to follow in the wake of the races that have already disappeared, and whose tomb is this continent. Look at the United States census for 1890, for 1880, and for 1870. Take the states east of the Alleghanies and north of the Potomac. Classify the population, into the rural on the one hand, and urban on the other, and see at what an enormous rate our city population is increasing relatively to the country population. Then think of the ravages that city life makes upon the physical constitution of the boys and the girls, and the men and the women of our race! Thinking of those things, do we not see that we have in this question of physical training about the most important question that could interest us, not merely as teachers, but as citizens of our country, and as men of our race? We cannot emphasize too strongly the need in our cities of something to counteract the ill effects of city ways of living, and in particular the ill effects of long confinement to our school-rooms, with their desks misfitting (as Dr. Hartwell has pointed out) seventy or eighty per cent. of the children. We need the physical exercises to counteract the ill effects of the furniture. We need them to counteract the effects of the poisonous atmosphere which children are compelled to breathe seven months out of the ten of the school term, owing to our very imperfect methods of warming and ventilation. We need them to counteract that kind of teaching, that kind of school exercise, which engages only the brain and the nerves. Dr. Stanley Hall well calls it, in a picturesque phrase, "this constant fiddling upon the nerves." We need physical exercises for the purpose, lastly, of giving to our children strong, healthy nerves, and brains, supplied with pure, arterial blood, able to work clearly, easily, joyously.

I wish in closing to throw out one suggestion. I gave the Ling system a full endorsement, from my point of view, as an outsider and non-expert. The Ling exercises mean business, from beginning to end. I recognize that. They are accurate, they are precise, they call for energy in a definite, particular way, they are excellent for cultivating the will. I will put my suggestion in the form of a question merely: Cannot you, who are professionally expert in the Ling gymnastics, modify them, add to them in some way, so that there shall be a little more of the element of play in

them, a little fun? I can understand that emulation gives a motive under which children will work, and that may be well used if not carried too far, but I want to see a little of that abounding fun which those of us over fifty remember in the school yards of our country towns. It is often said, "Oh, yes, these Ling gymnastics are all very good, but how much better it would be if we could have the free play of the school-yard!" It is easy enough to say that, but if you go through the city of New York, the city of Boston, of Chicago, any large city, you find the school-yards—what? Sometimes you find no school-yards at all, but in the best circumstances you find a school-yard of a few hundred square feet and on that at recess time massed anywhere from 500 to 1,000 boys of all sizes. And half a dozen teachers on the ground, for what? Why, simply to keep the big boys from killing the little ones. There is no play. The teachers attempt nothing but to keep the boys from quarreling with each other, or teasing one another, or,—what I dislike even more than either of those things,—skulking off into a corner, standing and talking with their hands in their pockets, and hatching mischief. That is about the picture of the city school play-ground. Some of the enterprising teachers would, we know, give a sort of military drill in the fresh air—an admirable thing to get the boys and girls out into the yard and into the fresh air for the Ling and any other exercises, as often as possible; but our climate does not permit that very much, and the greater part of the exercises must be taken indoors. But let us, if possible, get a little more of the element of play into the Ling exercises, and then, from my point of view, they will be about perfect.

Dr. Jay W. Seaver.—I am sure we owe very much to Boston for educational information, and we are glad to have a report of the influence of physical education on Boston school children. I believe that what is possible in Boston is possible almost anywhere else, and that wherever we have fine teachers in the schools we shall have successful reports, as we have this afternoon, from people who are actively interested in the educational side of physical training.

REMARKS ON THE USE OF ANTHROPOMETRICAL MEASUREMENTS IN SCHOOLS.

BY DR. WILLIAM TOWNSEND PORTER, OF HARVARD MEDICAL SCHOOL.

The time in which we now live will always be memorable as the beginning of a great educational reform. It has seen the complete demonstration of a law which is causing a revolution in educational methods, the law that the physical strength of the child and his power to do school work go hand in hand. It has seen the partial introduction of systematic measurements of children and the systematic employment of these measurements in fitting school work to the pupil's strength. It will yet see the universal adoption of this rational and beneficent principle.

It is therefore of the first importance that the ideas which underlie the physical measurement of children should be clearly understood and that the limitations of the methods by which these measurements may be applied practically should be distinctly recognized. And this is the more important because the methods in question are of only approximate correctness and are thus open to attack by those who would discredit the whole movement, forgetting, in their zeal for flawless methods, that even an imperfect tool may serve a pressing need.

The use of anthropometrical measurements in schools rests on the fundamental truth that the average or other central value of a group of properly related measurements gives an idea of the character of the group. Thus, the average height of boys aged nine affords a basis for a mental picture of the height of all boys of that age. The central value adopted becomes in this way the type of the objects measured.

The central value gives in itself no information concerning the degree in which the individuals of the group differ from the central value. Common observation, however, teaches that giants and dwarfs are rare and that the physical dimensions of children of the same age differ within relatively narrow limits. The central value comes thus to include the conception that extreme deviations are infrequent and that most of the individual measurements in the group lie near the central value. This materially strengthens the idea of type.

The type value thus developed is found to increase in size from year to year, according to a definite law. Thus the type or central value at age ten is larger than at age seven. Sexual differences are also established. It is found that the central value for girls up to age twelve and after age fourteen is less than for boys of the same age, while from age twelve to age fifteen it is greater. This fact is expressed by saying that the typical girl is larger than the typical boy during the prepubertal period.

It cannot be too strongly insisted that the laws just mentioned are the laws of growth of type and not necessarily the laws of individual growth. Yet the fundamental conception of central value or type permits their application to individuals within certain limits. It has already been pointed out that the type idea includes the conception that most of the individuals in the group lie near the central value. It has been said, also, that the central value of both sexes increases from year to year and that the central value for girls during the ages twelve to fifteen is larger than that for boys. The first and second of these truths enable us to say that the chances are that any individual boy or girl will increase in size from year to year. The first and third justify the statement that if a boy and girl of the same age are selected at random, the chances are that the boy will be larger than the girl except during the ages twelve to fifteen.

The fundamental conception of type permits us to go further. The central value of the whole number of boys or girls at any age is typical of that whole number. The individuals above the central value form a group of larger, and those below a group of smaller, children. The two groups stand in our minds, by deduction from the fundamental idea of type, as large and small children. Then the central value of the upper group will be typical of large children and the central value of the lower typical of small children.

The central values of the two groups at each year in the period of growth convey an idea of the size of large and small children respectively at each year. The increase in these central values from year to year cannot, however, by deduction from the fundamental idea of type be termed the growth of the typically large and the typically small child. The fundamental idea limits us strictly to the central values of large and small children at any one year.

This limitation becomes clear at once when it is remembered that although the fundamental idea of type includes the conception that an individual selected by chance will seldom vary greatly from the central value, it does not give any information whatever as to the direction of the variation, whether above or below the central value. Consequently it cannot be said, as a deduction from the fundamental idea of type, that an individual found above the central value of the whole number at any age will be found above the central value of the whole number at any subsequent age. The side of the central value of the whole number on which he may be found cannot be inferred from the fundamental idea of type. Those who, like myself, have written of the growth of the typically large and the typically small child have assumed that children remain approximately at the same distance from the central value of their age and sex throughout their period of growth. They have assumed, for example, that a boy who at age seven is above the central value of his age will probably remain above; in other words, that large boys usually grow to be large men. This assumption has evidently no necessary connection with the fundamental idea of type. Its present justification is derived from the very general opinion that violent oscillations in the growth of the individuals are on the whole uncommon. The importance of testing this belief by annual measurements of the same children and the use to which the information thus secured could be put in predicting future growth, will be presently made clear.

The division of the whole number at any age into those above and those below the central value suggests a farther division. This is well accomplished by the method of Francis Galton, according to which the individuals at any age are arranged in order from the smallest to the largest and divided into percentile grades. The relation between the size of any child and the size of other children of the series measured may thus be known. It may be found for example that a boy is taller than 40 per cent. of the other boys measured at his age and not so tall as 60 per cent. If the series measured is very large, the observation may be safely generalized and the boy declared taller than 40 per cent. of all boys of his age, race, and social condition. Percentile grades find, therefore, an important and legitimate use in determining percentile rank at any year.

Percentile grades cannot, however, be used for prediction of future size. It cannot, for example, be positively said that a boy who at age ten is heavier than 70 per cent. of boys of his age will at age fifteen be heavier than 70 per cent. of boys at that age. The objection to such a statement has already been pointed out in the remarks on the central values of the groups of large and small children. The objection was that it is not positively known whether the individual remains in the same percentile grade, *i. e.*, at the same distance from the central value, from year to year. But this limitation, I may once more insist, does not affect the use of the percentile grades to determine percentile rank in any one year.

There is much difference of opinion as to what should be taken for the central value. The use of the average (arithmetical mean) to express the fundamental idea of type is an immemorial custom. Quetelet, having demonstrated that children's heights and weights at any age were distributed about the central value approximately in the form of a probability curve and believing, incorrectly, that the distribution of an infinite number of measurements would be perfectly symmetrical, chose the most frequent value (value moyenne). Galton has proposed the 50 percentile grade (median value), and Boas has recently advocated a fourth value, which takes account of the fact that the distribution curve at any age is not perfectly symmetrical. The most frequent value is now seldom or never used. Almost all investigators have employed the average. Some have based their work on both average and 50 percentile grade.

In this state of uncertainty as to which of these values most nearly represents the true type, it is necessary to determine whether the differences between them are large enough to cause a serious error in their practical use. Dr. Bowditch and I have shown that the difference between median and average values is small where a large number of measurements is made. The difference between the average and Boas' value is also small. These facts justify the belief that the difference between any one of these three values and the true type is without practical importance. For the difference between the average, for example, and the true type value is very much less than the error which unavoidably accompanies the attempt to fix the relation of a growing child to the type child and,

for practical purposes, may, therefore, be neglected. For the present, then, the average, or, if the number of measurements is large, the 50 percentile grade, may for practical purposes be taken as a sufficiently close approximation of the true type value.

The sharp discussion concerning the value which should be taken as the type has, perhaps, given this question undue importance in the eyes of the practical educator. For the theory of statistics the question is indeed of great importance, but it does not particularly affect the use of anthropometrical measurements in schools.

The use of anthropometrical measurements in schools finds its best justification in the acknowledged or tacitly accepted truths that the work required of the pupil of average strength cannot be done without injury by the pupil of less than average strength, and that the strength of children can be estimated from physical measurements. The problem, then, is to divide the pupils into two physical grades, the first including those whose physical development makes it probable that they can do the usual school work of their age without injury; the second, those whose physical development makes it probable that they cannot do this work without injury and who, therefore, demand special care and watchfulness.

The physical measurements which are to serve as the basis of this division should be, for economic reasons, the fewest possible consistent with the end in view. It is generally believed that the ratio between weight and height is the best easily determinable measure of strength in dealing with great numbers of individuals. The division may, therefore, be made on the basis of the ratio of weight to height. The principle of division should be the following: Of 1,000 boys of the same age 500 will fall between the 75 and the 25 percentile grades. The weights of this central 500 will be the usual and hence presumably normal weights of boys of that age. The chances are one against one that the weight of any boy of that age selected by chance will fall within the limits mentioned. If the weight of the boy is greater than the 75, or less than the 25, percentile grade, the chances are that the weight is unusual and therefore abnormal. The greater the deviation, the greater the probability that the weight is abnormal. The line which separates the probably normal weight from the probably abnormal weight may, therefore, be drawn at the 75 and the 25 percentile grades. The

same considerations hold good for height and for the ratio of weight to height. Undoubtedly this ratio should be derived from the 75 and 25 percentile grades of the weight to height ratios of a great number of children at each age. Such material is unfortunately not yet collected in sufficient quantity. For the present, therefore, it will be necessary to find these ratios by dividing the values at the percentile grades of weight by the values at the percentile grades of height.

It will not escape notice that these operations are carried out without the use of the central value and that the practical educator is thus not directly concerned in the controversy over the central value. For the present, at least, the height to weight ratio at the 75 and 25 percentile grades will serve his purpose.

I say "for the present" because the future should bring a great advance in the use of anthropometrical measurements in schools. It has already been several times insisted that the data in our possession do not suffice for certain prediction of future growth. In other words, this material does not determine with exactness the rate of growth of the individual. The present data have been collected by the generalizing method, that is by measuring once a large number of children of different ages, classifying the measurements by age, and assuming that the values obtained are those that would have been had children of the same age been measured yearly throughout their period of growth. The generalizing method deals with units rather than individuals. The children who furnish the measurements for age eight are not the children who furnish the measurements for age nine. They are different for each year. The results, therefore, say nothing as to the growth of the individual child from year to year, except what may be inferred from the increase in the type value. If the boy X and the boy Y, who, at age seven, are in the 75 and the 25 percentile grades respectively, change places at age eight, the central value will be unaffected by the change, for the distribution of units is the same as before but the growth curve of the individual boys will show a large deviation.

This lack of material is especially to be regretted because the rate of growth or annual increase is certainly a more reliable guide than the height and weight at any one year. The lacking material, how-

ever, can be easily collected, and those in charge of schools should see to it that measurements of the same children are made annually or oftener throughout their school life. In the course of fifteen or twenty years such measurements would solve the crucial problem of the exact relation of the individual to the type.

Those who reflect upon the questions mentioned in these pages will hardly avoid the conclusion that the gaps in the theory of child growth do not prevent the extended use of anthropometrical measurements in schools.

There are, no doubt, many opinions as to the way in which such measurements should be employed. As to details, such differences are inevitable and are to be welcomed rather than regretted. On the other hand, a difference of opinion as to main working lines is to be deprecated, for these lines are the logical outcome of fundamental principles. The working plan of every system grounded on these principles should provide for (1) the annual record of the height and weight of every pupil; and (2) the placing of pupils whose weight to height ratio is above the 75 or below the 25 percentile grade of their age under special supervision, in order that they may not be overtaxed by the work which is exacted of the normal child.

SOME OF THE PRINCIPLES THAT GUIDE ME IN TEACHING GERMAN GYMNASTICS.

BY DR. E. H. ARNOLD, OF NEW HAVEN.

I read this paper in answer to many requests for a statement of the principles underlying German gymnastics. These requests emanate chiefly from those people who have been hazardous enough to adopt almost every feature of our system, even though they did not see and know the principles of it. On the other hand, this paper is to meet those of our friends who state positively that there are no principles at the bottom of our gymnastics, and that, therefore, there is no need of asking for them.

The trouble with both parties is mainly that they look at gymnastics from their standpoint only, and that they cannot recognize

principles which treat of gymnastics from a different point of view than their own.

I shall characterize, shortly, two of the main directions in which gymnastic thought has been directed by our critics so exclusively that they cannot and will not recognize any thought which does not exclusively and entirely tend in that same direction.

There is, first, what I shall style the developmental school of gymnasts, that think gymnastics must look about like the following, to be up to their standard: Man is a complicated machine, the motion or locomotion of which depends mainly upon three factors: the levers (bones) on which the machine moves; the powers by which these levers are moved (muscles); and finally, the apparatus distributing and supplying fuel to muscles, the apparatus of respiration and circulation.

Having these three main factors in mind, the question was, Are these factors commensurable? The question seemed to be an easy one to solve. Measuring rod, tape, calipers, the spirometer, the sphygmograph, should state all about these factors. In order to make the results of any practical value for the work on the floor of the gymnasium, a standard of measurement had to be established, as an aim at which to direct the efforts at physical development. We have seen the model man, the normal man, the average man, and the typical man, rise, and, I may say, fall; for the ideas of this school of gymnastics have been greatly modified, in order to meet the demands of a rational system of gymnastics. Why so? While the figures gained by the above apparatus, and their tabulation, comparison, etc., are useful and interesting in the extreme for gaining an idea of the make-up and build of the machine, they do not by any means convey any idea of the effectiveness of the machine. They do not give the truth absolute, nor relative.

Let us look at the matter of leverage. It is comparatively easy to measure the bones, but to establish the leverage we must know the exact point of origin and insertion of the muscles in question into the bony surfaces. To establish these with absolute accuracy is not only not easy, but in all cases pretty difficult,—in a good many cases altogether impossible. Our uncertainty grows as we look at our measurements of the executive powers, the muscles. In general, it is true that a big bulk of muscle means great power;

but are the measurements of a muscle or a group of muscles any indication as to what power may be expected of them in an individual? again only in a general way, but not absolute at all. The reasons are as follows:

The efficacy of a muscle depends first, on its bulk, as represented *about* by its transverse section, of which quantity we can *about* judge by the measuring tape; second, on its leverage, as established by points of origin and insertion, a quantity which we can, again, only *about* judge by the measuring rod; third, on the arrangement of its fibres. Of this quantity we know something in general, but for individual cases we can, once more, only *about* judge as to its value. The absolute truth the dissecting table only can reveal. Now last, but not least, comes the fourth factor,—viz.: the innervation. This factor is so complicated a one that we may put it down as yet incommensurable.

If these, then, are the doubtful factors which are at the foundation of our building, what kind of a building can you expect to stand upon it? And thus it is. The effort at building up an average machine guided by anthropometric hints, is effective as far as giving bulk of muscle is concerned. Whether the bony levers or the leverage (insertion and origin) are changed is rather doubtful, as is a change of arrangement of muscle fibres; and, finally, the innervation, a factor of the highest importance, is not affected at all by exercises as prescribed under the guidance of the measuring rod and tape.

This is, of course, not new, even to the followers of the developmental school. They have seen the shortcomings of their scheme, and the measurements have been supplemented by tests of effectiveness of groups of muscles, and of the machine as a whole. This method must of necessity be the preferable one, if a way of correctly measuring a muscle or a group of muscles can be found. But this is not the case as yet, and will not be the case for some time, as the machinery needed for such a purpose will be extremely complicated and require for its construction a genius of no low order.

That the fourth factor will need considering, even in the strength tests, may be illustrated by the following every-day observation:

If a man should undergo one of these tests in the seclusion of a laboratory, and then, under otherwise equal conditions, before an

audience, the result will differ greatly; showing that the nervous factor differs, not only in quantity in different individuals, but in quality in the same individual. Our psychologists are busily engaged in their laboratories, trying to find ways and means by which to make this, our fourth factor, commensurable. I expect to hear something on this side of the question from Dr. Fitz, of Harvard.

If this be, then, the scientific basis upon which the developmental school of gymnasts rests its art, can it wonder that we are not willing to accept principles which are not yet satisfactorily established? Is it strange that one looking for principles of this kind in our system of gymnastics should be disappointed? Then, to turn to the practical side of the question. We may well ask, will exercises of other character than those given as so-called prescription work accomplish the same end? And if so, is the time and labor spent with prescription work not lost, if we can give exercises which serve at the same time hygienic and educational purposes, as well as developmental ones?

On the other hand, we must consider whether a developmental scheme of gymnastics, which must of necessity deal with each individual separately, will ever be practical for the people at large, and not only for higher institutions of learning. How are such factors in development as social condition going to be dealt with? (Some twenty years ago investigations were carried on by some German anthropometrists, as to the difference in development of children in cities, villages, settlements of miners, etc., showing distinctly that such things had decided effect on development.) What attitude will this school of gymnasts take towards the individual whose development is completed?

All these questions will have to be solved and answered before principles can find their way into our system of gymnastics, which tend in this direction. Until such time, the results of gymnastics on the developing organism may tell us about what mechanical work to expect of the human machinery, but cannot serve as a guide for a system of gymnastics which is intended for the mass of the people, for the school of our time, which deals with classes and not with individuals. In this it may do harm to a limited degree to an individual; but that is the way of other organizations, as the school and the state, which look out for the greatest amount of good to the

greatest number, and thereby necessarily infringe upon the rights and privileges of the individual.

I shall now turn to another school of gymnastics, which I shall style the hygienic school. This title may not suit it altogether, as this school claims to be following educational pursuits, too; but any one reading from its declaration of principles will find that the day's order of this school is built up on hygienic reasoning, and that the educational side is really of less than secondary importance.

The main objection of the followers of this school to our system has been that they have not been able to find any hygienic principles underlying our system. On the educational side of the question they have not attacked us, as that is not their own strong point.

I may state right here that hygienic principles and rules are with us of two-fold value. Their positive value is that they guide us in a general way for selecting material, but not in a specific way. Their negative value is that they serve us as contra-indications for certain forms of exercises, under certain conditions as given by different age and sex, etc. Any one who has read Dr. Schmidt's able little book will admit that we have hygienic principles, and coincide with me in saying that they serve mainly as contra-indications.

If, then, our hygienic rules determine for us classes and forms of exercises only generally, not in detail, not the exercises themselves, what principles guide me in making up sets of exercises?

Before I answer this question, I must tell you why I cannot allow hygienic rules and considerations to do any more for me. I regard all exercises arranged to have specific effect on circulation and respiration as futile. I cannot assign to circulation and respiration the first place, when considering them for establishing gymnastic principles. They both serve only part of one function, viz., nutrition. Nutrition is dependent on a good many more factors than circulation and respiration. They fulfil their mission under guidance of nervous influences. These nervous influences are of a peculiar kind. We have no control over them by will. We may interfere with the respiratory movements by will, to a certain limited degree, but we cannot wilfully stop respiration altogether, nor can we regulate it for any length of time. Nor does our interference affect anything but inhalation and exhalation. That is the most crude process in respiration, that might be called outer respira-

tion. Over the exchange of gases from air in the lung to the blood, middle respiration, and over the inner respiration, *i. e.*, the exchange of gases from blood to tissue, and *vice versa*, we have no wilful control whatsoever.

If this be true of respiration, it is equally and much more true of circulation. Over this we have no wilful influence, if we exclude the interference of wilfully regulated respiration and its effect on circulation by way of thoracic aspiration. Both apparatuses are self-adjusting, self-regulating, not only as far as rate of speed and capacity is concerned, but different reserve forces are called into play. Our heart dilates, hypertrophies under some forms of exercise temporarily, to contract and atrophy after the condition calling for the first change has disappeared. Indeed, the apparatus is working automatically, adjusting itself to the conditions of health and even of disease, with the utmost facility and accuracy.

What, then, of efforts of improving upon this automatic adjustability by exercise for which a specific effect is claimed, an effect which must of necessity be different in each individual? Nor can the followers of this school claim that the specific effect is had, even in general, as tabulated by them. I recall to you observations presented to you at our last meeting in New Haven, by Dr. William G. Anderson, disproving the claim that slow leg movements decreased the heart's action.

Are the other claims perhaps equally fallacious? To me, it seems not desirable to meddle with this automatic, self-adjusting apparatus, as we can but replace it by adjustment by will, which does not pay attention at all to the conditions and necessities of adjustment in the individual, which necessarily must be very crude as compared with the apparatus with which we all are fitted out naturally. Just imagine under what tremendous handicap a man would be living and working who would have to wilfully adjust respiration and circulation. Is it not true that people who are aware, constantly or temporarily, of their heart's action, are living in a state of worry and anxiety which renders them unfit for any kind of work, and ends in madness if the condition is not relieved? Should we ever have evolved into our present state of development if we had to stop and pay attention to the most vegetative processes that we have in animal life? And just think of what practical value these hygienic

teachings are for everyday life. Did you ever see a man after a brisk run to catch a car or train, take slow leg movements? Would you, if pursued by a mad dog, after having run to the point of exhaustion, stop one moment to think how your heart would be affected if you should climb that saving tree which you ultimately reach? Would you perform slow leg movements after you reached the top of that tree? What mechanic, whose calling asks him to bend his trunk forward, thinks of taking a bend backward every time he has bent forward, or to always alternate sideward, right, and left trunk bendings? And yet, our hygienic friends try to persuade us that this is the only way to the salvation of our physique. Yet they claim to be educators. Have they ever heard of the principle that whatever is to be taught in school is to be taught, not for the school, but for life? What, if these principles taught by them were true, would have become, long ere this, of the human race, that did not know of all these essential things for health? Is it not a wonder that we are not all hump-backed and lop-sided? Why has not the species *homo sapiens* become extinct through heart failure? Why is it that we have ever reached any age beyond that of the small boy, for I am sure he runs without following up with slow leg movements; he bends forward a hundred times and never backward; he climbs a tree much higher than his vital index entitles him to, and commits daily a thousand more sins against the code of health of our hygienic gymnasts; and yet he lives. The small boy has not become extinct, and he is not going to behave differently in the future, just to please some people who labor under misconceptions as to the true condition of the human heart. For verily, ladies and gentlemen, our hearts and lungs are made of much better stuff than our hygienic friends would make us believe; and the adjustment of their working is much more neat and delicate than all the hygienists could devise for some time to come; for this adjustment has been evolved by the conditions and circumstances of life, and any change in this adjustment will come by way of our organs adapting themselves to new conditions, but not by way of edicts of the school room and laboratory.

We are therefore contented to improve these two factors in life in our gymnastic system by increasing their function in a general way, leaving the regulation of their activity to the apparatus provided for

that end; and are honest and modest enough to admit that we, with our present limited knowledge, know of no means by which to alter or improve this apparatus. Our hygienic principles are really of negative value, inasmuch as they serve as contra-indications, as before said. Therefore you perhaps will understand now why we have been accused of having no principles (*i. e.*, hygienic principles) underlying our system of gymnastics.

After having told you why we cannot and do not work on these two bases, I shall try to sketch in gross outline some of the principles on which we—or at least I—are basing the German system of gymnastics. With me, gymnastics are mainly an art, or a science, if you wish, which teaches the use of our muscular apparatus in the most efficient way; *i. e.*, adjust motion and locomotion so that the greatest amount of work may be done with the smallest expenditure of force. The two elements which are concerned in performing such work are the muscular and the nervous elements. Each movement is, in the first place, a mechanical problem. The given factors are weight, the resistance to be overcome, and space, the way or distance which the movement is to traverse. In order that this problem be solved so that just sufficient muscular force be expended and no more, the first thing necessary is that we have a correct appreciation of both factors, weight and distance. To gain this, a receptive apparatus is presupposed, consisting of the senses of sight and touch. You all are, very likely, well acquainted with the very complicated way in which we learn to judge of distance; how the sense of sight, of itself, is unable to convey the idea of distance or dimensions; how the sense of touch, and that as yet not well-defined part of it called muscular sense, must combine and tell of their experience as regards the resistance met, contraction necessary, etc., in order to fetch a certain member of the body to a certain point of view; how we must memorize that a certain contraction of the ciliary muscle was necessary in order to adjust the lens; how certain recti and oblique muscles of the eye had to contract in order to bring in view a good distinct picture of a limb so moved; how the experiences so gained have to be stored, classified, compared, combined; how they are latent and become kinetic when there is need of it. The process of learning to appreciate weight is of course a similar one. It is plain that, before we can commence to judge of

distances between things other than ourselves, and of weights and resistance of foreign bodies, we must learn of the distances and dimensions of our own body and the relation of the different members to one another; and likewise we have to learn the weight of our own body and its members before we can learn of the weight of foreign bodies. This teaching, of course, commences with the first day of our life, and goes on at a very rapid rate in youth.

Yet this natural method of teaching is not sufficient,—is in a great many things, if not altogether incorrect, only approximately true. And so I regard it as the first step in educational gymnastics that correct ideas of these conditions and relations of the body and its members be gained; that the receptive apparatus be taught to make correct observations; that the centers classify and store them properly; and finally, that these latent experiences be, at the proper time, compared, combined, and discharged as impulses in the way that is wanted. That is to say, that at the same time that we teach the receptive powers we teach the executive powers a lesson in coördinate movement, for a certain purpose, in a certain way.

We begin, then, with what is termed free gymnastics, *i. e.*, gymnastics of the body and its members, pure and simple. The teaching must begin, to repeat a commonplace, with the simple. As we can concentrate our attention for correct observations only on one thing at a time, we must begin to move a single part of the body only, at first. We move our motile apparatus in its joints in all the possibilities of the joint, and thereby get certain kinds of forms of movement. Flexion and extension, raising and lowering, rotating, etc., are these fundamental forms which offèr mechanical problems that differ in the factors weight and distance.

How do we go about the teaching of these single movements of a single part of the body? Do we move, for instance, the arm as a whole first, or do we commence with the movements of the wrist and fingers? We teach movements of the limb as a whole, trunk as a whole, etc., first. Why? Because the acuteness of perception of difference of pressure decreases with too great and too small weights offering resistance. Thus, while an arm or a leg or the whole trunk moved into different attitudes is large enough to be accurately perceived, the fingers, for instance, would offer too small difference in weight for accurate perception.

To what degree is a motion in a joint to be taught at first? To its full extent, for the sense of sight perceives large differences of extent in motion with greater accuracy than very small ones. Do we execute at first very quickly or very slowly? With moderate swiftness, for the above reasons. These are the reasons we do not teach fine positions of hand, wrist, and fingers, like Delsarteans, nor partial trunk movements, like our Swedish friends, until our pupils are advanced. We teach then, as the first step, gross movements of one limb as a whole, to the full extent of mobility in its joints, with moderate celerity. As movements in the different joints are possible in different planes, we must determine whether there is any difference in difficulty of execution in the different planes.

This brings us to the matter of directions. The senses which have mainly to do with the adjustment of coördinate motion, sight and touch, point forward. It is therefore easily explained why coördinate motion should be easiest and most accurate of execution, in the forward direction. To discern things on either side of us by either senses asks for complicated muscular movements. The eye, respectively the head, have to be turned in order to gain distinct pictures of things on either side of us. That part of the tactile apparatus whereby we judge of dimensions of bodies, viz., the fingers, respectively the hands, hang down by the side; but the finger tips, which are on the anatomical front side of the hand, need turning, the arm raising, in order to gain knowledge of the bodies on our side. The number of tactile corpuscles is greater on the front side of the body. That means greater facility for movements forward, less for the side. The rear side of our body is not fitted out with special senses. The tactile corpuscles are few and far between; the facilities for accurate movement backward are few; coördinate motion backward is most difficult.

Not only are the facilities in the way of direction and supply of sensory apparatus graded in this way, but the possibility and range of motion is in general arranged on the same plan, viz., greatest forward, sideward less, backward smallest. This is in some instances not very apparent, nevertheless true. If in simple movements of one member of the body only, this gradation does not show very plainly; that is no doubt due to the fact that a child that enters school has had a certain amount of training in coördination,

with Nature as a teacher. But as soon as we commence to combine movements, the value of the above gradation will at once be seen. Is it at all necessary to combine motions? Are simple motions not sufficient? If we were not teaching for life, they would suffice. But life offers us continually new coördination problems which are complex and combined movements. This is one reason why we must combine. Another reason is this: If movements are to be done in the most economical way, the saving must not only be in muscular matter, but a great deal more saving can and must be done of nervous matter. It is at once apparent that if, for the coördinate movements, the whole nervous apparatus had to be moved, that is to say, that it would require for every new movement and its repetition a distinct reasoning process and an act of volition, we would never have time to think of anything but movements, and mental growth would be impossible. It is easily seen why it is then necessary to exclude certain nervous processes from such movements by having these moves performed sub-consciously, automatically, or reflexly. How is this to be attained? By establishing what may be styled a muscular memory. That is to say, certain solved coördination problems must be stored in our mind so that when time and occasion offer they may be reproduced in their already solved state. How can such a memory be gotten? By often rhythmically repeating simple forms of exercise that have first been executed by command. Here we differ with schools who command every move, thereby preventing the creation of such muscular memory, and wasting a great amount of volition power which might be used in other fields of activity with great benefit. After such a memory of simple forms of movements has been established, *i. e.*, after these moves are automatically performed with accuracy, then comes the time for the second manner in which to make moves sub-conscious, viz., combination of simple moves.

Under what rules are exercises combined? You may well ask; for to him who is a casual observer only, and looks at exercises performed in a German gymnasium, it does not seem that they are combined according to any rule whatsoever; and he could style them, with our friend, Professor Mosso, a conglomerate. I shall try to prove to you that they are combined under well-defined rules.

As a matter of experience, it may be stated that it is easier to

move two like parts of a body in a certain way—for instance, two arms, two legs; next come the combined moves of two unlike parts —one leg, one arm, arm and head, trunk and leg. As far as the exercising of the extremities goes, unlike parts of the same side can be worked easier than unlike parts of unlike sides. The construction, position, and arrangement of the cerebral and spinal centers and conducting apparatus make this plausible enough; a communication of the centers being proved by the fact that after operations on the brain, when parts have been removed or destroyed, and paralysis of a group of muscles follows, that the center commonly attending motion of the other side may supply both sides with the necessary motor impulses.

But the subject of combining exercises is not solely governed by this factor; directions play an important role. It is easier to move two parts in like directions, more difficult to move them in opposite directions, and most difficult to move them in different directions. That is to say, two arms may be moved easiest forward, it is more difficult to move one arm forward and the other backward, most difficult to move one arm forward and the other sideward. The fact that like movements of some parts in some directions are of course attended to by the same set of muscles, movements in opposite directions by antagonistic sets, movements in different directions by groups of muscles that have no such relation, is no doubt the reason for this fact, which is a matter of experience on the floor of the gymnasium.

It may again not be apparent in combined movements of only two members, on account of the above mentioned natural teaching of coördination already had by the young gymnast, but is plainly brought out by combinations of a higher degree, where we find that the gradation holds good as far as accuracy of degree of motion, its swiftness, etc., are concerned. Combined forms of movements become executable in that order, in rhythm sub-consciously, automatically. The number of errors occurring in the different forms cited increases in the order named.

All these reasons, although only empirical, have proved the point to my satisfaction. If you, who have the time and occasion to work in psychological laboratories, will set to work to test these assertions by scientific apparatus and in a scientific way, I have no

doubt that although I may by your researches be corrected in detail, I am not going to be found at fault altogether.

But the subject of coördination is not exhausted with the matter of directions. The forms of movement come in for consideration, and follow very closely the scale put down for directions. I find movements of like forms—for instance, raising—to be easier of execution, and what has been said of innervation will explain this fact. Next in difficulty range opposite forms of movements—for instance, raising and lowering. I base this observation on the principle that a coördinate motion carries its own impulse for reversion; an act of will is only necessary to set the time when reversion is to take place (when exercises are executed by command); and then this act is not one of conscious volition, as long as the exercise is performed rhythmically. When we consider that a coördinate motion is for its degree of accuracy and swiftness dependent, not so much on the action of the muscles directly performing it, but on the antagonistic group participating in the move in the way that we may, with our Swedish friends, style excentric, then it may easily be seen why these muscles should, through this partial contraction and relaxation, receive the stimulus which would tend to their complete contraction or relaxation, *i. e.*, the reversion of the original motion. Naturally gravity will always be a stimulus for the reversion of motions which must be considered, and will explain the gradation above established.

These reasons explain, too, why different forms of movements—as, for instance, the raising of one arm and the carrying of the other arm through a horizontal plane from right to left—are most difficult, and, therefore, stand at the top of our gradation, for they profit not by the same innervation, as cited for exercises of the same form, and the impulses for reversion are here, instead of a help, a resistance to the motion.

We do not stop at combining the movements of two parts of the body. We may execute a move of the head, both arms, the trunk, and both legs, all in the same, opposite, or different directions, in the same, opposite, or different forms of movement which represent the highest grade of coördination problem that we are able to give.

These are the principles that guide me in teaching German free gymnastics. Any one who sees these complex forms of exercises

may think them useless, a mere conglomerate of positions and moves, theatricals; and yet they are necessary for making complex coördination sub-conscious, automatic, reflex, if such is possible, and yet accurate in degree and swiftness. A person who can execute such a complex movement in quick time, with accuracy, and perform it rhythmically, without error, may well be said to have control of his body; and as he is working with the least amount of nervous force, volition being gradually reduced and excluded, he is performing it in the most economical way.

These principles hold good for marching, running, jumping, and apparatus work; and I find that since I have graded and arranged my work according to this idea I have less correcting to do, execution of exercises is more accurate, I have to do less chiding, as errors are less in number, as now I can explain errors and attribute them either to my teaching, to the subject matter of teaching, or to the inattention or bad will of the pupil. Discipline has thus been greatly simplified.

I have arranged a progressive table of free gymnastics embodying these principles, but it is of necessity such a lengthy affair that I shall not try to give it to you to-day. Neither shall I attempt to recite to you the principles that guide me in teaching jumping, apparatus work, games, etc., as I fear I have already taken too much of your time; but I shall be only too glad to do so at the first opportunity offered me.

DISCUSSION.

Dr. Gulick.—I would like to ask Dr. Arnold if I understand that this is a statement of the principles of the German system of gymnastics, as understood and taught at the normal school and as carried out by the teachers of gymnastics of the German schools, or is it his own.

Mr. Arnold.—In general, it may be said to be that of the gymnastic school at Milwaukee. In detail, perhaps, it is my own.

Dr. Gulick.—These principles have been formulated and are taught at the German school at Milwaukee?

Mr. Arnold.—That I do not know.

Dr. Fitz.—I am very much interested in this discussion. I have

heard a great deal said about the Germans having no principles to work upon, and other systems having all the principles that were to be had. But it seems to me that we have to consider what the principles are. I took occasion to congratulate some German teachers a year ago upon the fact that they did not have to use a few cut and dried theories upon physical training. I see no cause to-day to withdraw my congratulations, because if there is anything which stops progress it is to formulate a set of rules by which things shall be done, and it seems to me that the Germans are distinctly to be congratulated upon being free from any such cast-iron limitations to their development, and especially as physiologists hesitate a good deal in prescribing exactly what shall be and what shall not be in the way of gymnastics; that which is good and that which is harmful: and when we consider that much of the cut and dried theory with regard to gymnastics of which we hear so much nowadays is nearly a century old, and that physiology did not exist as a science at that time, it makes us question its value. For myself, I don't know as I can think of all the adjectives I would wish to apply to these physiological theories which have been imported for our benefit. They are very simple, entirely logical, very superficial, delightfully fantastic, and mostly absurd.

PRACTICAL METHODS OF TEACHING PHYSICAL EXERCISES TO PUBLIC SCHOOL CHILDREN.

BY J. GARDNER SMITH, M. D., NEW YORK.

[Abstract.]

This is a day of specialism. There is a tendency on the part of both teachers and pupils to give special attention to some one or two studies or educational branches and lose sight of the great field of learning and the purpose of teaching and being taught.

We have special teachers in many branches, and by some it is thought best to have a special teacher for every study, who shall go from school to school and room to room teaching special work, while the class teacher becomes a sort of monitor or clerk. In this way physical exercises may be taught to the various grades and classes.

A very practical objection to this method is found in the fact that this method requires a large number of special teachers and the money to promote it properly can scarcely be obtained. Again, the special teacher under these conditions has no personal influence upon the class or its members; both teaching and study become mechanical. Again, the class teacher will not hold the respect of the class if she becomes a mere monitor and not a master of the various branches of her grade. We do not expect to furnish in the class room or the gymnasium all the exercises necessary to the pupil's health and higher education, but simply to teach the elements of exercise with and without light and heavy apparatus; that the scholar may use this knowledge and be able to utilize the exercises most needed out of school hours and in after life.

From the experience of the past four years in New York city, and from observation and inquiry in other fields of work, it would seem a far better plan to prepare the class teacher to teach the exercises of her grade. We would suggest that one man with a good general education and special training in physical culture, and, if possible, a medical education, be made the supervisor of this branch. He might meet the teachers of various grades once each week, or once each month, and by the use of skeleton, manikin, and class exercises, make plain to the teacher the exercises best adapted to her class. The grade teachers may be seen once each week, or once each month, as may be necessary.

The exercises of the various grades should be printed and illustrated by photo-engraving, and placed in the hands of each teacher. The supervisor, after teaching a sufficient amount of work for the ensuing week or month, should visit the class to ascertain whether the work as taught is thoroughly understood and properly taught to the scholars.

The teachers should understand the class exercises thoroughly, being able not merely to teach the exercises themselves, but to explain to the scholars their physiological effect. In this way the interest of the pupil is increased, and a steady rational growth of the work may be expected.

In New York city each grade uses different apparatus and has a different group of exercises, graded according to the physical and mental conditions of the scholars. These groups of exercises are

so arranged as to be easily taught during the term. In the lower primary grades, for instance, are taught very simple free exercises without any apparatus; the next higher grade uses rings; the next higher grade, ¼ and ½ pound wooden dumb-bells; the third grade uses short wands; the second grade, light wooden dumb-bells, and the first grade, very light Indian clubs. Thus each grade uses different apparatus and has the benefit of a system of exercises progressively graded.

In the grammar department the same plan is carried out. The first grade grammar, for instance, learns a very intricate set of Indian-club exercises; the second grade, an intricate bar-ball drill; the third grade, a difficult dumb-bell drill, etc., down to the eighth grade, which latter practises the United States setting-up drill, with some modifications.

These graded exercises are adapted to gymnasiums, play rooms, and class rooms, and may be practised without the use of any apparatus whatever, where for various reasons it is inadvisable to use apparatus.

This work you saw illustrated last evening at the armory, where four hundred children from the lowest primary and the highest grammar within half an hour showed nearly all the work of the various grades.

The exercises are so arranged that they may be accompanied by piano or other music, which adds to the pleasure and recreative effect of the work.

Thus far this plan has elicited the interest of all conscientious teachers. They have entered the work heartily and have executed it faithfully, as is shown in the more erect and graceful carriage, combined with better health, better discipline, and better mental work on the part of the scholars.

DISCUSSION.

Miss Bancroft.—I would like to ask Dr. Smith a few questions, but first to explain a little this matter of the supervisors of physical training in the different schools. It is a method we have tried in Brooklyn, and we have found it to work very successfully. I don't know of its being tried anywhere else in this country. In our Brooklyn schools we have, of course, a principal at the head of each school; and in all but the smaller primary schools, heads of depart-

ments—in other words, assistant principals. Sometimes there is one, sometimes two, even three, of these assistant principals in a school. They have charge of a department, just as the principal has general charge of the entire school; and they are responsible for the work done in that department, whatever it be. Now these heads of departments, and in a good many cases the principal himself, and occasionally a class teacher acting as substitute, serve as supervisors of physical training for their department. They meet with the director for instructions in the physical exercises, and in turn, meet their teachers and give the work to them, and the teachers give it to the children. The latter get it at third hand.

I was very skeptical of the success of introducing the work in that way, but in a very short time we found that the work was more thoroughly incorporated and the standard higher than we could possibly have obtained in the same time in any other way than by a large corps of specialists. Those supervisors met at first once a week for their instructions. They were thoroughly drilled on every movement to be taken; it was explained to them; it was seen that they could do it themselves; they were told how to teach their teachers; what faults to look for with the teachers and with the children. Being daily on the ground to see what the teachers were doing and to correct mistakes, it has surprised me to see how very quickly these people, who have never had gymnastic training, have come to see and appreciate both good work and errors—and I would like to say to Dr. Smith that they did see their children once a week.

Then in very many of the schools we have department drills, at the end of the week. The class-room work that has been given for three days by the regular teacher is taken all together in the department, and generally the supervisor conducts that herself. It is a little reward to the children, so to speak, and gives the enthusiasm of numbers.

We have never tried physical examinations, because in some of the schools we almost had panics when the children had to be vaccinated last year. It occurs to me to say that I have also had meetings with the class teachers themselves right through the year, giving them personal instruction, but that is incidental or extra. Their main work is with the supervisors. I would like also to ask Dr. Smith what his distinction is between exercises and drills.

DR. SMITH.—I did n't mean to make any distinction.

MISS BANCROFT.—You spoke of teaching the children only exercises, rather than a drill, that they have to do over and over.

DR. SMITH.—When the scholars are examined, perhaps there are some exercises that they ought not to do. I would like to ask Miss Bancroft, who teaches those scholars through the week?

DR. EHINGER.—I would like to ask if it is not far better for us to so train the public school teachers at the normal schools that they may be capable of instructing their pupils in elementary gymnastics. Even in cities where regular gymnastic instructors are employed these teachers would coöperate more willingly and intelligently than in the absence of such knowledge.

Now, if we had time, I would like very much to explain what work we have done in this way at the West Chester State Normal School and how many of our graduates have introduced gymnastics into their country schools and how much better they are prepared for having had the previous training with us.

Is it not clearly apparent that if all those who are now attending the regular normal schools could have a modified course of training similar to that given at a school of gymnastics, that we would have vastly better results than under the system suggested where we have either a special teacher in gymnastics or no gymnastic work whatever? Such training is not given with a view to preparing specialists in this branch but simply to enable the regular teacher to give some instruction in this much neglected field in connection with other school duties.

MR. EBERHARD.—I think perhaps, in order to arrive at a conclusion as to what we should aim at in public schools, it might not be inappropriate to make a remark about drills or no drills. We spent a good deal of time yesterday in talking about military tactics, etc. The expression was used, "playing at a soldier." Now these drills seem to me little more than playing at gymnastics. Neither the Swedes nor the Germans follow this method of teaching, and it is being, or ought to be, discarded by others.

We have heard much about drills with Indian clubs. Now I would like to ask, what is the physiological value of such a drill? Is n't it just as valueless as walking at a leisurely gait, as a physical exercise? I think walking has long ago been considered as no physical

exercise at all in the sense of what we consider exercise, and a drill with Indian clubs, to my mind, is about on a par with walking. I think we ought to aim at a succession of exercises, not these little, good-looking, fancy drills of little or no physiological or educational value.

DR. ARNOLD.—It is true that the drill is very likely not the ideal at which Dr. Smith is aiming in New York. I think he is working under a condition which makes it necessary that he should drill. I think he is doing the best he can. If he had teachers at his command who could teach a class independently, he would not have to drill. But I cannot see the necessity of his spending so much work on measurements, which are of no practical value, inasmuch as he scarcely has teachers who can meet classes and teach without first learning the drills themselves, and they cannot teach special work. When that is the condition there is no use measuring.

DR. FITZ.—It is a very important question that Mr. Eberhard has opened up, and one that we should spend some time upon; not necessarily this morning, however. There are several things one seeks for through gymnastics, and the educational side is only one. It seems to me that the hygienic side is extremely important, and undoubtedly a drill gives rise to a development of muscle and the acceleration of certain functions which is decidedly beneficial. So from the hygienic standpoint the drill is of value, and of great value, although educationally it has practically no value, except when it is being learned and then in extending the experience of the individual. In listening to Dr. Smith's paper, this thing occurred to me, which I shall put in the form of a question: Did I understand Dr. Smith to say that he gave a single (or a simple?) exercise for a week, and then changed to others? and were these exercises such as to bring into play large muscle groups of the body, or were they simply specialized drills for the sake of learning a school drill, adopted because of the general exercise which could be gotten from them when all were learned?

DR. SCHÆFFER.—I wish to thank Dr. Smith for bringing out the fact that the educational work in the schools should stimulate pupils to reproduce their exercises, outside, from the interest involved in them, and should lead them to take other outdoor exercise. Indian clubs, wands, and other apparatus of that kind, do furnish motive for exer-

cise to people who would not otherwise take such exercise, and perhaps would forget all about the necessity for it. There is a certain alphabet of movement that the pupil ought to learn, and that alphabet, in my judgment, is best expressed by the precision of the Swedish system; afterwards let the recreative element be very strongly introduced, as furnishing a means of sustaining interest.

Miss Bancroft.—It seems to me that the function of public school work is not so much to develop a strong body as to prevent the body from growing weaker under the conditions of school life.

Mr. Eberhard.—My remarks seem to have been misunderstood by some of the ladies and gentlemen present. I did not mean them at all as a criticism of Dr. Smith's work. I asked the questions merely to bring out clearly what we should aim at in our public school work.

Dr. Beyer.—The last gentleman that spoke asked a very legitimate question. To my mind, drills were introduced for the simple reason that every individual cannot have a special teacher at the same time. There is a faculty which is not unworthy of cultivation, and that is concerted action. It seems to me that to the drill particularly belongs the advantage of action in concert.

Dr. Savage.—Of course we all understand that Dr. Smith is not going to be able, with the time and means limited, to carry out perfectly a theoretical plan, but this point has impressed itself upon me. I deal with children, girls, boys, and men.

If any of my pupils are taking exercise occasionally, once, twice, three times a week in the gymnasium, they are four times as liable to do some exercise at home. They come and want to know what machine they shall put up at home. I say, "If you are going to work in the gymnasium a few times a week put up a machine; you will use it. But if you do not work in the gymnasium, your machine at home will be forgotten." That applies to the children that are getting a little work. They will go home and do that work. They try it themselves, and others, and get a good deal more out of it than most do with a class in school hours.

Mr. Moody.—In Dr. Smith's paper it was one of the strongest points that the children should be taught a drill so that they could remember it, and take the exercises by themselves after they had left

school. I know that pupils of mine have come to me years afterward, and said they had derived great benefit from being taught the drills that they could remember.

PHYSICAL EDUCATION IN NORMAL SCHOOLS.

BY C. E. EHINGER, M. D., OF WEST CHESTER, PA.

In the spring of 1894 the writer sent a circular letter to all the normal schools in the country, or at least to all whose names were found upon the list furnished by the last report of the United States commissioner of education. The letter was directed to the principal or the instructor of gymnastics, and contained a list of thirteen questions as follows:

1. Is any form of gymnastic exercise regularly employed at your school?
2. How much time is given to gymnastics?
3. Is a regular instructor employed? Name of?
4. Is instructor a graduate of a normal school of gymnastics? If so, what one?
5. Is any special system of gymnastics taught? If so, what?
6. Is gymnastics compulsory for all students?
7. Where are the exercises taken?
8. Is a gymnastic costume required or generally worn?
9. Is any instruction given in the theory of gymnastics?
10. Is any attempt made to equip special students of gymnastics?
11. Are students given practice work in this department?
12. Are all students given physical measurements?
13. If so, what system?

One hundred and seventy-nine of these circulars were sent out. Ninety-seven answers were received, and the leading replies have been tabulated with the following results:

Number of circulars mailed, 179.
Number of replies received, 97.

1. Number of schools claiming to give gymnastics regularly, 74.
2. Average time per week devoted to gymnastics, 70 minutes.
3. Number of schools having regular directors, 51.

4. Number having two or more instructors, 7.
5. Number of instructors who are graduates of normal schools of gymnastics, 17.
6. Number where some regular system of gymnastics is employed, 50.
   Number using American, eclectic, or mixed systems, 27.
   Number using Swedish—presumably exclusively, 14.
   Number using Delsarte—presumably exclusively, 5.
   Number using German—presumably exclusively, 4.
7. Number making gymnastics compulsory, 52.
8. Number having gymnasia, 24.
9. Number requiring gymnastic costume for exercise, 19.
10. Number giving instruction in theory of gymnastics, 32.
11. Number claiming to prepare special students or teachers of gymnastics, 5.
12. Number requiring practice teaching in gymnastics, 41.
13. Number giving all students physical measurements, 11.
14. Number using recognized system of measures and strength tests, 10.

Three schools have military drill for young men.

Though the questions in some instances were misunderstood, as was clearly evident from the answers, this table probably gives a fairly good idea of how much has been done toward introducing gymnastics into the normal schools of our country.

The showing is, I am sure, in some respects misleading, and represents a condition of affairs better than really exists. Still, I believe, it may be taken as a fair criterion of the progress normal schools have made in this field.

The promoters of the cause of physical education can hardly find in this table cause for congratulation. Yet, I believe, if a similar table had been compiled five years ago, when the writer entered this field in normal schools, the comparison would be very favorable, and indicate a healthy growth.

Many of the circulars which were returned with the questions properly answered, were accompanied by letters from principals, lamenting the fact that more favorable replies could not be given, and expressing the utmost sympathy with the movement.

In quite a number of instances the writers explained that new buildings were contemplated or were in process of erection in which provision for a gymnasium had been made. Within the past year

several fine buildings have been constructed by normal schools which are devoted exclusively to gymnastics.

An encouraging feature in this connection is that, if normal schools have been tardy in taking up the matter, they are at least displaying a commendable energy in making suitable provision when it is at last introduced. In almost every recent instance which has come under the writer's notice, they have shown a generosity and good judgment that bespeaks a more serious consideration of the subject.

Aside from the direct question of adequate means for inaugurating this movement, the fact that many of these institutions are wholly or partially under state control, militates against the work in various ways, it requiring more effort and a longer time to set in operation the necessary machinery. Dependence upon legislative enactment has, unquestionably, hampered the cause. In many cases radical changes in the curricula were necessary before gymnastics could be thought of.

One thing seemed evident from the replies brought out by this circular, namely: that the normal school authorities are, on the whole, quite alive to the subject, and we may safely predict that the movement will continue steadily to advance.

The most needful thing now seems to be a full discussion of the matter and a free interchange of ideas between the school faculties and trustees on the one hand and specialists in physical training on the other. The problem presents difficulties which can only be cleared up by intelligent thought and practical experience.

I am convinced that the matter has not received a full enough statement from competent hands. The special need of gymnastic training in normal schools has not been clearly set forth.

The introduction of this work into the normal schools does not, as in public schools, depend so much upon a popular demand for and appreciation of the need for physical training. It is a question resting rather more in the hands of the school managers. Once the teaching corps and boards of these institutions are convinced of the urgent need of the physical betterment of their charges, and the great importance of preparing the future teachers to impart this much-needed instruction and the movement need not wait upon public opinion, any legislative assistance which is required will be forthcoming.

It must be admitted that there is not in most communities the intelligent understanding of this subject on the part of the average patron of the public schools which will call for its speedy application. The general feeling, where it is given any consideration, is rather in favor of relegating the physical care of the children wholly to the parent or leaving it to the natural impulse for exercise exhibited by the child, to his instinctive tendencies and desire for physical games and pastimes.

Suffice it to say that this is not the opinion of those best capable of judging, and this being the case, what measures shall be taken to overcome the misconceptions, indifference, and opposition?

In the estimation of the writer one of the most important, if not *the most important* step, is the question of physical training in normal schools. If the teaching of gymnastics in our public schools is ever to become an established fact, it must be accomplished largely by means of the regular teacher. Outside of the cities, the employment of specialists to conduct this branch of education is out of the question. Neither can we expect the already overworked teachers to readily adopt these newer ideas, to change long established customs, and while carrying on their regular work, to properly qualify themselves to instruct in this branch without some protest.

On the whole, the best teachers are those who begin their work with the fullest equipment. And whether or not the normal schools have accomplished all that they aim to, it must be admitted that as a rule the normal graduate comes to his work far better prepared, and meets with greater success than the one who has not enjoyed such preparatory training. In other words, physical training will best be introduced by teachers who have had some special preparation for such duties; therefore let the work begin where it properly should, with the normal graduate. These schools with their model practice or training departments, courses in methods of teaching and psychology, are preëminently the place to prepare the public school teachers to instruct in this subject. I do not mean to imply that they should in any sense take the place of, or interfere with, the regular normal schools of gymnastics; their purposes are different and an ample field is open for both.

The training of a teacher is not complete unless the methods and

means of physical development are included. The day of one-sided teaching is, or should be, past.

How child study can be properly pursued without a thorough study of the habitual movements, and postures, and other physical expressions of the child; and the full understanding that these are the indices of the action of corresponding nerve centres, and the corrollary that physical development means mental development, I can hardly understand. The laws of mental and physical growth, the truths of psychology and physiology, so overlap and interpenetrate that they become inseparable. Child study is the basis of pedagogy, and the new education will no longer tolerate those methods which put the physical needs of the child as secondary to the mental. The training must be coincident. Education is a psycho-physical process.

Physical education as applied to normal schools should mean something more than mere gymnastics; it should include the fundamentals of the philosophy and methods of health. A course for the regular normal school should properly comprehend an abbreviated and modified form of the systems pursued in the best normal schools of gymnastics, including the theory and history of gymnastics in general; lectures and demonstrations on anthropometry supplemented by a series of talks and a course of reading upon the growth and development of children, with an occasional clinic illustrating the more common defects and physical deformities met with among school children.

The relation of athletics and games to physical training should receive careful attention. The results of the physical measurements of the general student body should be utilized for study. Some of the valuable papers of Bowditch, Galton, Roberts, Porter, and others should be reviewed. These subjects are not to be taken up with the expectation that public school teachers can ever give much practical attention to anthropometry, the correction of deformities, etc. But rather to give that broad foundation which every person who devotes his life to the important calling of a teacher should possess. In no other way can that which alone is vital be brought out. It would do wonders to dispel the superficial and harmful notions that physical training means only the memorizing and repe-

tition of physical movements, which are calculated solely to develop muscle.

The study of physiology and psychology should be so planned as to supplement and corroborate the teaching in this department.

The study of hygiene,—and by this I mean something more than the trite little maxims which are appended to the average school physiology—should receive the thorough and serious consideration which its importance to a teacher demands. So far as my knowledge goes, normal schools have been almost criminally negligent in this matter.

I maintain that the rational teaching of hygiene, and more particularly school hygiene, is second in importance to no other subject in the normal school curriculum.

As a physician and a physical educator I wish to put in my urgent plea for more and better teaching of hygiene.

In the name of common sense and experience, what can there be of more paramount concern to the teacher?

I venture to predict that the time is not far distant when this grave neglect will be recognized and remedied; when we will look back with shame upon these omissions.

Let us early recognize in our schools and their teachings that prevention and not palliation is to be the coming watchword; that it is ever easier and better to avert disease, deformity, or moral perversion than to attempt to correct or re-adjust abnormal conditions.

The whole trend of modern reform in every department of human affairs is tending toward prophylaxis,—a clear understanding of the cause of our infirmities that only the real remedies may be applied.

Give us in our normal schools departments of physical education which are all that the name implies, make it an object for the best teachers to seek their management, and the reproach which is now so often justly heaped upon them, will be speedily removed.

I think every intelligent observer in this field will admit that in no other department of school or college life does the tendency under slight provocation to degeneration become so rapid and fatal as in the physical. Some one has well said, in substance that "nothing is so easy to get up enthusiasm over as gymnastics, and in nothing

is it so difficult to sustain it." The force of these words must be apparent to all who have had any experience in this line.

Let us be candid and acknowledge that but too often alas! the physical training department is a perfect sham, a miserable makeshift. The lesson has not yet been thoroughly enough learned that *physical* proficiency and gymnastic equipment do not constitute a department of physical training. Not only muscle and agility are requisite but also *brains*, backed by the *moral* as well as the financial support of the institution.

The reasons for the weakness of the physical training departments are many, and cannot be enumerated in a few words, but some of the most apparent ones can be mentioned. The tendency to use this department as a mere advertisement, a card to draw a certain class of students, to cater to the popular demand for "physical culture," is not one of the least of these mistakes.

Spacious and well-constructed gymnasia with full equipment are eminently desirable, but not if they must be had at the cost of providing poorly paid or ill-qualified directors.

The time is ripe to drop the "fad" element in "physical culture," and to cease useless discussions concerning systems to unite upon the vital issues of the cause.

Let us rejoice over, and give the honest hand of congratulation and support to, every substantial advance, whether it favors the one or the other system. Let the advocates of each set its standard so high that it compels the respect of all others concerning that which alone is worthy in any system of development.

It is both the duty and object of this association to take active steps toward the cultivation of this splendid field.

Let our words and our works bear the stamp of earnestness, and intelligent effort and physical education will *command* respect.

Until physical training is placed upon the same basis as the more purely intellectual branches in normal schools, and given time commensurate with its importance, it must fail to accomplish its highest purposes. This work should be as carefully graded, conscientiously taught, and strictly counted for promotion and permanent certificates as mathematics or other customary branches. Unless some such principles are strenuously enforced physical training can never become a coördinate part of public school teaching.

And now one more thought in closing these fragmentary suggestions,—I believe it is the function of this association to see that the medical profession at large is given a better understanding of this subject, that they may, as they properly should be, powerful allies which they certainly have not been in the past. The very source from which we should have received our most active support has contributed but meagrely to our cause.

It is only fair to say that this great body has been, on the whole, either apathetic, unconsciously, or actively, in opposition to our best interests. Is it not our manifest duty to see that the future physician commences his professional career with some adequate understanding of this subject, that he may give us the support and coöperation which are but natural and proper?

In other words, can we not take some immediate steps toward having this subject given a proper recognition and presentation in the curriculum of our medical schools?

Miss Bancroft.—I emphasize the importance of work in the normal schools, and I am sure that every director in public schools will agree with me. Every one who has felt the dead weight of working up teachers, many of whom have fallen into the set ways that come with years and find it hard to take up a new thing, will understand the necessity of instruction in physical training in the normal schools. There is room also, it seems to me, for greater coöperation between the directors of physical training in the public and normal schools. I should think that the division of this association into sectional meetings as proposed would help this very much. It seems to me that the matter of theoretical training is very important, and one which would give room for a good deal of discussion in these sectional meetings: how much theoretical work could be given to the teachers, or how much in the normal school. I should like to know what Mrs. Lawrence thinks of that. Do you do any theoretical work in the college here?

Mrs. Lawrence.—This winter I have been training the seniors to teach Swedish gymnastics in the aisles of the class rooms. I have given them as much theory as I have had time for; perhaps five or six hours of theory from November until April. They only had an hour's lesson once a week in this Swedish work. I don't believe in the teachers all through the schools being expected to teach gymnas-

tics, for I don't think they can do the subject justice. Next year I am to have a special teacher to go around through the class rooms, and will not then have to depend on the regular class teachers.

Miss Bancroft.—I agree with Mrs. Lawrence that it would be very nice if we could have special teachers, but I think the point Dr. Ehinger made a true one,—that in large cities it is going to be almost impossible to have enough specialists, on account of the expense.

Mrs. Lawrence.—I think if we make a fight for it, we shall carry our point. I don't know why school-boards are willing to have special teachers for music, special teachers for drawing, special teachers for everything except physical training. I, for one, have made a firm stand, and have gained my point in this institution.

Miss Scarborough.—I think the length of time of the normal school course is two years, in some cases three. The time that is taken in normal schools of gymnastics to prepare teachers is two years, I think. I think we do not turn out any too good teachers, devoting the whole of the two years time, in schools of gymnastics; and what can we expect of the regular normal school student, who has a thousand other things to study, and do it all in two years? I would like to inquire of Dr. Ehinger how long a time he would recommend giving to the subject of gymnastics in state normal schools.

Dr. Ehinger.—I think my remarks have been misunderstood. In the first place, I think Miss Bancroft misunderstood my remark about large cities. What I meant to say was that in country districts we never can have special teachers; it is utterly out of the question. Now the point is, shall we not prepare our normal school graduates to give some instruction in this work? It was expected that Dr. Boice would have a paper, and there was an understanding that I should treat only one phase of the subject. Hence my presentation is not what it would have been had this understanding not been entered into. But I think the best plan and the one we follow at our own normal school, is simply to prepare the teacher to give free gymnastics in the public schools, and to give them sufficient theoretical knowledge to work understandingly.

Dr. Hartwell.—I quite agree with Dr. Ehinger and others who have spoken upon this subject. You cannot introduce gymnastics of any kind into a school system and hope to have it leavened by them until after a good many marriages or funerals have taken place.

It is simply impossible, under existing conditions. In Massachusetts, for instance, women constitute nine tenths of the teaching force. Their education is practically finished before they begin to teach. You cannot expect them to take up a new subject like gymnastics and handle it with the same ease, interest, and success as the subjects in which they were trained in the normal school. It is a bitter commentary on our existing normal schools that we have to establish summer schools, and special schools for training teachers of gymnastics. It seems to me that it is the business of the state, which compels so many of our children to go to school, to provide their children with the kind of teachers that they need. Gymnastics have too frequently been introduced by school commissioners and superintendents out of deference to faddists whom they were desirous to conciliate. It is a mistake to suppose that, once a system of school gymnastics is adopted by vote, it can be left to run itself.

There are two aspects, it seems to me, to the question as to whether gymnastics shall be taught by the class teacher or a special teacher. Unquestionably there is present need of each. Let us not forget that a complete system of gymnastics has not been introduced into any of our public school systems. We talk about Swedish systems being adopted in schools in which only free movements are employed, and argue for or against them without taking into account the fact that Swedish gymnastics include a wide range of exercises, that require a gymnasium and an adequate supply of apparatus quite as much as the German system requires them. The elementary schools in Paris, as the result of the well-directed work of a recent governmental commission, are better organized for effective instruction in apparatus gymnastics than are our high schools in the United States, with few exceptions,—or our normal schools either, as a class.

Miss Bancroft.—On this question of specialists, I would like to say, in answer to Mrs. Lawrence's point, that even with the number of special teachers in music and drawing which we have in the schools, the regular class teacher has a great deal to do. The specialists visit the schools once or twice a week, and on the intervening days the class teacher carries out their instructions. I do not deny that the teaching of the specialist is ahead of that of the class teacher, but it seems to me that it is a little impracticable to have it throughout our large school organizations.

THE GYMNASTIC AND THE ATHLETIC ERA OF PHYSICAL EDUCATION.

BY DR. E. HITCHCOCK, OF AMHERST COLLEGE.

Previous to 1860, about the time of the late Civil War, the subject of physical education, or any special study of bodily care and development, hardly had a foothold among our educational problems, or in the community at large. In fact, boards of health in this country at that time had not been established. But with the vast number of exemptions from the draft for our army, and with the immense number of recruits who because of poor physique and inability to undergo exposure and hard work could not endure the discipline and hardship of a soldier's life, the thinking public came to ask, why is this, and what can be done to better these conditions?

Probably the first step in this direction is to be found in the inaugural address of President W. A. Stearns of Amherst college in 1854, where he says that "no course of education was complete without devoting special attention to secure a good development and health of the physical system." As a result of his persistent efforts, in 1859 and '60 a department of Hygiene and Physical Education was established at Amherst College, and a professor was appointed with the same standing and powers as the other professors of the college. This was followed by the erection of a suitable gymnasium building and the introduction of a system of required physical exercise, and of oversight of the health of the students, which has been steadily maintained till this day.

This was a starting point for the work of the college and school gymnasiums, which meant the light and required class exercise of dumb-bells, Indian clubs, wands, rings, and free body exercises, together with the voluntary use of apparatus very much after the pattern of German, English, and French gymnasiums. Added to this during the war were simple military company movements and the manual of arms. And as a natural consequence this led to the introduction of class competitions, prize exhibitions, and records of gymnastic feats.

For several years Amherst College went on alone in this new

departure, with no encouragement from anybody and with the criticism that it would be as impossible to require people to exercise in a systematic manner, as it would to compel them to eat, sleep, or believe in a particular religious creed, by the requirements of a curriculum or course of study. And yet in the course of ten years a few of the older colleges and the better preparatory schools found their way to putting gymnastic apparatus into a vacant room or hall and encouraging the students to go to these places and regularly use the means for recreation. From this beginning the work has gone on, till now there is hardly a respectable college or fitting school in the country which has not, at least, its gymnasium; and very many of them have a physician or director who has the immediate control of the instruction given and of the department.

Close upon the establishment of such departments at our colleges, followed the gymnastic idea which has seized upon the Y. M. C. A. work. This means a physical director and a gymnasium wherever a reasonably strong association exists in the United States.

So much then for the gymnastic period of physical education, the era in which the public has been educated to the need of simple muscular exercise, and the supply of the means and men to carry forward along with the culture of the intellect this primary necessity of a better care for and development of the body. This means the minimum supply of bodily exercise by which young men, women, and children in our educational institutions can hope to maintain and probably make better their bodily condition. And the good which this era has accomplished is seen in the decidedly better physique of our school and college people, the ability the better to sing and declaim because of a stronger body to make a better voice. A better carriage is seen in our youth as a result of these gymnastic exercises, and on account of the military element which to a small extent is a concomitant of gymnastic training. No one old enough to institute a comparison between thirty years ago and to-day will for a moment hesitate to notice a better and more vigorous, active, and earnest condition of physical life in our schools and colleges; and we who have been in the business for some part of this time shall surely claim, with no lack of modesty, that a goodly portion of this is due to the introduction of that department of education which cares for the body as well as the intellect. So marked is this result

that the last thirty years might be termed the gymnastic epoch of American education.

This interest on the part of directors, leaders, and teachers in educational matters has led to the recognition of, and supplied the material means for, advanced instruction in these subjects. Among the later developments and the matured results of this more intelligent physical training we note an enlarged view of the true value of recreation, physical development, and out-of-door amusements. While the required indoor exercise, regular, methodical, and prescribed, has been, and must continue to be, fundamental, and a necessary requirement for the great mass of students, the very success of it has led on to better and more vigorous work for a large proportion of our students. Work indoors at the gymnasium with apparatus, and a little military drill, is good, is an absolute necessity, and can be regularly maintained. Favorable conditions can always be commanded, because it is within doors, and is not affected by the weather. It will always reach those who must feel some compulsion before they will take any exercise. But this is not the natural or ideal form of exercise. Men like animals want air, sunlight, exposure to all the elements of nature, rain or sunshine, and a contact with mother earth. And in such exercise they should wear such clothing that they may move as freely as the animal in his native haunt. A man may get simple muscular development in a gymnasium and be strong in arms, legs, lungs, and back, but he cannot get the real brawn, effective muscle, capacious lungs, a tough skin, and the best of digestion or a really reliable heart, unless he gets more of the natural process of health from mother earth and her surroundings of air, water, temperature, ozone, and the actual touch of soil and grass. No animal even with the utmost care on the part of man thrives in the house. For who can take more care of our cows, horses, and dogs than do the owners who count their money as nothing in comparison with them, and yet what a woe to us is tuberculosis in cattle and the many diseases of the horse? Man needs outdoor discipline as well as that of its training masters indoors, if he would secure the bodily condition and the physical power that make him the best man to conduct a business, to edit a newspaper, or to make the most effective use of high intellectual attainments in any calling.

Hence in the last few years have grown up the athletic sports

which demand the field, the air, varied temperatures, and the sunshine, and the test of strength, skill, and sport between man and man. The races and competitions for speed and time, the feats, the sports, the capabilities of quickness and strength, go back for their origin as accepted necessities, to Greek and Roman times. And they have come in again to stay.

But foot-ball seems now to have a black eye, and because of some of its concomitants, with good reason. Because it has been abused by its friends and by its backers has been debased to unworthy ulterior purposes, it receives much deserved criticism.

Excess, perversion, and overdoing are eminently American dangers; moderation, self-restrained and rational attention to amusements which men enjoy, are rare virtues among us.

Probably any person competent to judge of physical education will assert that foot-ball, when its players are adjudged sound and competent to play by a medical director and where it is governed by a reasonable code of rules, is a most healthful, vigorous, and valuable game for youth and young men. It requires not only physical prowess, promptness, alacrity, and steadiness, but also elements of mental acuteness and even of moral stamina which are excellent training for the problems of thought and leadership in after life. To play foot-ball a man must look out for and protect himself. He must also be the aggressor against the other side, and so must hold his temper and learn withal to be righteous with his opponent. He must expect defeat again and again and must meet it like a man. And these we claim are necessities for a greater part of the public conditions of all our lives, and whatever disciplines us for this work early, helps us to be the better fitted for the stern work of life that assails us all at some time. But foot-ball has its accidents and calamities. So does every sport and occupation of life. But we claim that dangers do not exist in foot-ball in any more excessive proportion than in a score of other occupations and amusements in life, when we consider the vigor put into the game, and the great strength of the men selected for these public exhibitions. Will somebody enumerate the accidents from bicycling, driving, and horseback exercise, and remembering how little is said of these many accidents, contrast with this silence the publicity given to every accident on the foot-ball field? Let us remember that every foot-ball game is watched and all its details are

published by the inevitable reporter, while the thousands of reckless riders and drivers are seldom brought under the reporter's eye. Foot-ball players are selected men. They have the best physique, the most wind, perfection of every sense, and vigorous hearts and circulation, and most of them are in such physical condition that harsh treatment is immediately repaired and overcome.

But foot-ball is the occasion of a great deal of roughness, brutality, gambling, and corruption, it is said. "Aye there's the rub." The superb game is degraded. Its victories are made occasions, by others than the players, for the indulgence of appetite, the undue display of college pride. Too much is made of victory. The game is not made solely a means for good bodily training and development, or for amusement and diversion; but everything is subordinated to the hope of beating the other team. It is the old Oxford and Cambridge struggle.

Mr. J. H. Choate once playfully characterized all our colleges as "fresh and salt water" ones, just as so many of the great cities and centres of power in the world are located on the sea from which they derive so much of their strength and resources. So the two or three big educational centres must to a great degree dominate and set the pace for the rest of our universities and colleges. And we unhesitatingly assert that were it not for the struggle between Harvard and Yale Universities for supremacy, we should hear but little about the horrors of foot-ball. All the younger and weaker institutions naturally look up to and expect much guidance and leadership from these old institutions. Oxford and Cambridge keep for old England by their emulation a higher tone of both physical and intellectual culture than if they ceased to vie with each other; and so in young America Yale and Harvard are keeping close to the mother country. And we believe that these two institutions—perhaps University of Pennsylvania and Princeton may be associated with them—can so arrange and direct the rules of the game and its associations, with its boisterous eclat, that the game may not bring down reproaches on their own heads, but may also allow the fresh-water cousins to enjoy and profit by it. There is no doubt that perfectly fair and unprejudiced judges, umpires, and scorers can be found, who with purified and strengthened regulations, and perhaps more of them, can keep the game within reasonable and healthful lines. And so we, "the colleges for

the plain people," demand of the leaders in education in this game which is of such great value and service, that the local institutional pride and prestige may be set aside for the great good of the whole Yankee nation. And that such restraint, oversight, and authority be placed over the game that Springfield of '94 cannot be reproduced under any circumstances, with, however, the perfect understanding that neither antagonist can allow "the pot to call the kettle black."

At the same time the great public must learn that the era of gymnastics, regular and normal development of the body, has come, and must stay for the great masses, but that at the same time this very fundamental work demands a broader and higher growth of physical prowess, and that the world demands and can have the necessary spectacular exhibitions without brutality, coarseness, unfairness, or indelicacy, even. The demand of the public for better health, public and individual, more bodily vigor and power, is on us, and surely it is for us to recognize in the athletic age. The gymnastic era has done its work; now let the era of athletics come in and benefit us as much in the next ten or twenty years as the gymnastic era has in the past.

SOME APPARENT RESULTS OF PHYSICAL TRAINING IN SECONDARY SCHOOLS.

BY JAY W. SEAVER, M. D., OF YALE UNIVERSITY.

The question has often been raised whether physical training is not a fad rather than an actual necessity of the times. The answer to this question must be drawn from the social and physical surroundings of our youth, and from measurable results that are seen when comparing groups of students who come from schools where different methods of physical training prevail.

It is certain that within the last thirty years the attention of educators has been turned toward gymnastic exercises, but often without due appreciation of the true purpose of this department of training. Many schools have engaged teachers of "physical culture" simply to cater to a popular demand, and to have in this department, as in any other, whatever patrons might clamor for. Others

have engaged teachers and built gymnasiums from a purely commercial motive, competition compelling them to provide such attractions as some rival school might boast. A third, and unfortunately the smallest class of all, is made up of those schools directed by true educators—men and women of bright mind and high appreciation of the actual needs of the community. These principals have, to a certain extent, rightly valued the possible advantages that should come to purely intellectual training and culture from a proper degree of physical education, which might be made concurrent with the mental discipline of the ordinary school.

The first two classes have engaged teachers just as most school boards secure them for the common schools, at so much per dozen, buying where they could buy cheapest, and inconsiderate of everything except the welfare of their own pocket-books. Lack of appreciation of the true purpose of physical training led them, perhaps naturally, to look upon the expert acrobat as the ideal teacher of this branch. It mattered little what the moral or intellectual standard of the gymnast might be, if he could only perform some few feats impossible to the ordinary school boy. It was considered that his prowess in these special lines was sufficient to excuse him from any special attainments in any other, and that the same standards of excellence did not apply to gymnastic teaching that applied to other phases of pedagogical work.

The result of this commercial method of looking at gymnastic work has been to discredit all instructors in physical branches; and not only the faculties with whom such so-called instructors were brought in contact, but the pupils who came under their direction, were left with only vivid recollections of a usually brainless and always godless individual, who for a short time came above their horizon, dazzled them with exhibitions of wonderful feats, and then passed from their field of vision, to be followed by some equally unworthy specimen of the genus acrobat.

Secondary schools have not been the only sinners in this matter of engaging gymnasts, rather than capable instructors, to take charge of departments of physical education. I vividly recall two instances where so-called universities have engaged men to act as instructors of the youth in their respective institutions, one of whom had his preparation for the work in the acrobatic training on the

sand lots of his native city, from which he was graduated to the position of street car track inspector, and from there to the directorship of the gymnasium. Doctors of philosophy and divinity sought him as an ally in their task of instructing the youth of the country. His work with the students can be imagined; and the reflex influence on that mass of young men is something that the careful parent and the true teacher must contemplate with a shudder. To my personal knowledge, within three years from the time he took the position, he was prescribing such drugs as tincture of digitalis to the runners who were under his so-called training, in order to strengthen the heart, as he said that running required great strength of that particular organ. The second individual, whose memory comes to me like a relic of Don Quixote, wrote me, after receiving his appointment as director of the gymnasium in the university, asking if I would be good enough to indicate some books which it would be profitable for him to read before beginning his work, as he must make some preparation before the opening of the term in September, and he had no familiarity with the books that one ought to have read to undertake such work. He said he had heard that I had written a book on anthropometry, and he wanted to know if I thought it would pay him to read it. I wrote to him in an exceedingly kindly spirit, telling him that it would be of no earthly use for him to read such a book—that since publishing it I had often wondered why I had ever written it. I suggested, as a preliminary course of reading, some little books like Gray's Anatomy, and that, as his time was short and the subject exceedingly important, he would better spend all his time on that one book. I might mention, in passing, that both of these men have graduated from their positions, much to the credit and relief of the college communities where they were located.

The real stimulus and encouragement to true teachers of physical education have come from the appreciation of their earnest and honest efforts by the advanced thinkers in pedagogical lines. It is but natural, then, that the influence of colleges should have been felt in the preparatory schools of the country. In those schools where the majority of the pupils have gone to colleges where the physical training has been of the same high grade as the intellectual training, there has been an influence always reacting upon them, to

provide physical training that should in some sense be of the same standard as the other lines of preparatory work. The result of this influence has been that many of the larger preparatory schools for boys have introduced into their curricula physical training as one of the requirements of the course, and in general this required work has been done with more thoroughness, if not with so much scientific accuracy, as that carried on in the colleges. If the colleges would now take an important step forward and demand a certain standard of physical excellence in those matriculating, it would do more for true physical training than all the legislating of our Solons. The warrant for such action would be found in the fact that the college is an eleemosynary institution, and, as custodian of funds, it is bound to see that they are not recklessly or carelessly distributed, but that they are bestowed on such individuals as are likely to make the best use of them, rather than on those who will hardly be able to use them at all except to consume them. The college capital should certainly be used for making good machines rather than poor ones.

We all remember a recent report from our honored ex-president, Dr. Hitchcock, in which he attributes the improved physical condition and increased size of men who have entered Amherst college in recent years to the better physical training they have had in preparatory schools like Williston seminary, Wilbraham academy, and others.

Bearing in mind Dr. Hitchcock's suggestion, I have undertaken to show by some figures, gathered from the men entering Yale in the last five years from different preparatory schools, the actual influence of physical training in the preparatory schools. For nine years every man who entered the academical department at Yale was measured, with only five exceptions. This material shows the condition of men who come from large schools where physical training is one of the preparatory requirements, as compared with that of men who have had their preparation in schools where there is no physical supervision of students whatever.

I present herewith a table that gives the result of this investigation:

	Age.	Weight.	Height.	Chest.	Biceps.	Thigh.	Lung Capacity.	Use Tobacco.	Physical condition.			Remarks.
									Good.	Fair.	Poor.	
Andover.....	19.5	63.2	1731	910	297	514	429	22%	68%	20%	12%	No gym.
Exeter.....	19.11	63.6	1720	930	307	519	403	26%	83%	10%	7%	Gym.
Hartford, H. S.....	19.4	59.5	1723	896	294	502	420	5%	70%	15%	15%	No gym.
Hopkins.....	19.5	61.8	1741	909	299	512	424	13%	60%	28%	12%	No gym.
Lawrenceville.....	19.1	63.2	1745	927	305	517	428	33%	70%	17%	12%	Gym.
New Haven, H. S...	18.8	60	1724	902	290	502	415	5%	55%	26%	19%	No gym.
St. Paul's.....	18.7	65.9	1746	923	311	541	411	26%	84%	6%	10%	Gym.
Williston.....	19.9	61.5	1722	919	299	521	444	6%	77%	13%	10%	Gym.

In studying the table of actual results here given, it is necessary to bear in mind a few points, or we shall form too hasty conclusions. We must remember, first of all, that to make the study complete, we should have the measurements of the boys who enter the preparatory school and trace their growth during the period of their residence in such school, for the clientele of each school is fairly distinct and drawn, to a considerable extent, from a special class in the community. In the second place, we must remember that the ages of these students is an important factor in discussing their relative physical development. Again, we must remember that schools unfavorably conditioned, as to physical training, are also often unfavorably located, so far as the distribution of their patrons is concerned. For instance, the New Haven high school undoubtedly sends many students to Yale, who would not be sent to college on account of their poor physical condition, if the near location of the university did not enable them to reside at home during the college course. The moral supervision of students in the various schools must also be an important factor in determining the physical condition of the student, as it has been demonstrated that the use of tobacco seriously interferes with physical growth. This interference is clearly demonstrated in the above table. We must also remember in drawing general conclusions from the above tables that the number of students is too small to give absolute results,

but it is believed that they demonstrate a trend in growth that is appreciable when all due allowances are made. It may be said that all these measurements were taken by me without knowledge of the preparatory school of the student.

One or two things are specially to be noted:

1. The varying sizes of the men who come from the different schools. This cannot all be explained by the fact of required exercise or lack of it, for we must remember that the early nutrition of children is a prominent factor in determining their ultimate size, and it may be stated, without provoking controversy, that some preparatory schools have comparatively few children whose early life has been unfavorable, so far as general nutrition is concerned, while others have a much larger percentage of pupils whose early surroundings have been unfavorable. Then, too, the element of heredity, which is an exceedingly prominent one, enters into the problem. The children of parent stock that has been for several generations favorably conditioned, must partake of the physical advantages enjoyed by their ancestors; while the well-nourished offspring of parents who have themselves sprung from stock unfavorably conditioned for nutrition cannot wholly escape those disadvantages.

2. The moral habits of a community may have a favorable or unfavorable influence on the physical growth of children. I notice in my tabulation that I have rarely found a student who uses tobacco among those who come from a certain school which sends many pupils to Yale every year. In a previous paper[1] I have called attention, as has also Dr. Hitchcock of Amherst, to the influence of the tobacco habit on physical growth during the college period of life. I can but feel that this deteriorating influence must be much more potent in earlier life, when growth is naturally more rapid. These various influences go to show that to understand the figures and interpret them rightly requires an insight into many phases of school life which are often overlooked.

3. Some schools have, fortunately, an established sentiment in favor of outdoor sports, and of gymnastic training as a preparation for those sports, so that, while there may be no required gymnastic exercises, the actual physical training of the students is of high

[1] University Magazine, June, 1891.

grade, and the physical results compare very favorably with those where the requirements are strict, but where the work is done in a desultory fashion and the interest centered on anything except the exercise taken.

4. Another factor, which it is worth our while to consider, entering into the problem, is that of early environment. City life is supposed to be especially unfavorable for the rearing of children, and many of our preparatory schools draw their patronage almost entirely from the cities, while other large schools are filled with boys from country homes. We should naturally expect a difference in the physical type from the two classes of institutions. If, then, we group together the large schools and academies where physical training is a part of the regular curriculum, and place in this list also those schools where physical training is required by the school sentiment rather than by edict of the faculty, and contrast the physical condition of students from these with that shown by men who come from such schools,—largely located in cities,—as have limited opportunities for outdoor exercise and do not require gymnasium work, it would seem that we might determine something of the value of physical training in promoting growth. The data gathered have been arranged in these two groups, and I call your attention to the difference in physical type in the two classes of institutions.

	Age.	Weight.	Height.	Chest.	Biceps.	Thigh.	Lung Cap.
City schools	19.2	60.4	1729	902	294	505	419
Country schools.....	19.5	63.5	1733	922	304	522	428

The product of the city schools reaches college younger than his country cousin, but is inferior to him in all physical points. The improved physical form is shown in chest, arm, and thigh girths, while our second special point acts to equalize lung capacity.

To sum up, it seems to me that we have here a mathematical demonstration of a value, actual and measurable, in gymnastic and athletic exercises for young men; and, if this be true, it would seem that the parent or guardian is inexcusable if he places his child or ward in a school where this essential element of preparation for future usefulness is ignored or slighted.

APPENDIX.

REPORT OF BUSINESS MEETINGS OF THE A. A. A. P. E., APRIL 25 AND APRIL 27, 1895.

Business meeting of the society was called to order at 8 : 30 p. m., Thursday, April 25, in the kindergarten room of the Teachers' College, by President Seaver.

Reading of the secretary's report was dispensed with, it having been published in the annual proceedings.

Treasurer's report was read and accepted. (See original annexed sheet.)

Committee on Elections, Dr. Hartwell, chairman, was called upon for report. As this was included in the new reörganization scheme, he was then requested to present this to the society for action.

It was voted to postpone the election of officers until the organization of the National Council as set forth in the new scheme.

It was voted that the plan presented by the Committee on Reörganization be tabled for printing, for distribution at the meeting Saturday morning.

Adjourned.

Business meeting called to order at 9 : 45, Saturday, April 27, in the lecture room, Teachers' College, President Seaver presiding.

Voted, To extend to Dr. Hitchcock, Sr., resolutions of sympathy in his not being able to attend these meetings.

Voted, That a Committee on Resolutions be appointed by the Chair. Drs. Seerley and Schaeffer, and Mr. Eberhard were appointed. Following is their report:

That the thanks of the association be tendered to the authorities of Teachers' College for the use of their building, and for placing at our disposal every facility in enjoying its many features of interest. To the officers of the N. G. S. N. Y., L. Fitzgerald, Brig.-Gen. First Div., and John V. Camp, Col. 22d Regt., through whose courtesy the use of the armory was obtained for our gymnastic exhibition.

To those whose executive ability has made our meeting such an interesting and successful one; and to the invited guests who have added so much to our programme. To the local executive committee for their untiring efforts in arranging the many details of

this occasion. To the president of our association, and to the various committees in charge of the special sections, for zeal and efficiency, with which our proceedings have been conducted.

F. N. SEERLEY,
EDWARD M. SCHAEFFER,
CHR. EBERHARD,
Committee.

Above resolution was accepted.

Among the list of new members voted in at this meeting was Henry Ling Taylor, M. D.

It was voted that the general scheme as presented by the reörganization committee be accepted, subject to such changes as may be deemed best.

Article 8, per printed sheet, was changed. (See Dr. Hartwell's sheet.)

Dr. Fitz withdrew his motion in regard to change of name, as presented last year.

Secretary instructed to correspond with the Ohio Valley society in regard to entering this association in accordance with the new idea.

Secretary instructed to acknowledge the presence of Dr. Arnold and Miss LeGarde, as delegates from the N. A. Turner-Bund.

Adjourned.

ANNUAL REPORT OF TREASURER

OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF PHYSICAL EDUCATION, FROM DATE OF LAST REPORT, MARCH 30, 1894, TO APRIL 25, 1895.

Balance in treasury, March 30, 1894,	$ 2.90
Receipts from dues and sale of Proceedings	455.10
Contributions to A. A. A. P. E. fund	341.00
Total	$799.00

DISBURSEMENTS.

City Printing Works, N. H., printing	$ 7.00	
Graves & Henry, printing	12.50	
Springfield Printing and Binding Co., balance interest on '92 Proceedings	110.40	
F. P. Thomas, printing	3.50	
C. H. Ryder, printing	22.15	
E. P. Lyon, postage and mailing '94 Reports	25.00	
C. H. Ryder, printing	8.50	
Dr. Luther Gulick, postage and stationery	19.73	
National Educational Association, printing '93 Proceedings	62.00	
Dr. J. W. Seaver, '93 Proceedings	31.35	
E. W. Scripture, drawing and photographs	3.00	
C. H. Ryder, printing	6.50	
C. H. Ryder, printing '94 Proceedings	213.30	
Treasurer, postage	17.00	
Treasurer, postage	1.00	
F. P. Thomas, printing	4.50	
E. P. Lyons, postage '93 Reports	38.75	
Total		586.18
Balance		$215.72

C. E. EHINGER,
Treasurer.

LIST OF MEMBERS OF THE A. A. A. P. E.

HONORARY MEMBERS.

Changes and corrections in names and addresses should be reported immediately to the corresponding secretary, G. W. Fitz, Cambridge, Mass.

H. P. Bowditch, M. D., Boston, Mass.
Mons. Georges Demeny, Paris, France.
Charles W. Eliot, LL. D., Cambridge, Mass.
Lieut. Col. G. M. Fox, South Camp, Aldershot, Hants, Eng.
F. S. Galton, F. R. S., London, England.
Augustus Hemenway, Boston, Mass.
G. Stanley Hall, Ph. D., LL. D., Worcester, Mass.
Charles Roberts, F. R. C. S., London, England.

ACTIVE AND ASSOCIATE MEMBERS.

Abbott, Helen Marian, 420 Cherokee street, South Bethlehem, Pa.
Adams, A. F., U. S. Nat'y Museum, Washington, D. C.
Adams, Adela W., 45 Oxford street, Cambridge, Mass.
Adams, Charles E., M. D.
Adams, Kate L., 63 Harvard avenue, Brookline, Mass.
Aldinger, A. K., Bloomsburg, Pa.
Aldrich, Charles S., Wesleyan University, Middletown, Conn.
Allen, Edward S., M. D., 2001 Race street, Philadelphia, Pa.
Allen, L. W., Y. M. C. A., Hartford, Conn.
Allen, Mary E., Allen Gymnasium, Boston, Mass.
Allen, Mabel, Providence, R. I.
Allen, W. E., Y. M. C. A. Training School, Springfield, Mass.
Amen, Harlan P., Phillips Exeter Academy, Exeter, N. H.
Anderson, H. S., University School, Cleveland, O.
Anderson, Lucy J., River Falls, Wis.
Anderson, Nellie L., Durant Gymnasium, Berkeley street, Boston, Mass.
Anderson, W. G., M. D., 315 York street, New Haven, Conn.
Angier, Alice, 53 Waban Park, Newton, Mass.
Armstrong, Lillian F., 40 East Montcalm street, Detroit, Mich.
Arnold, E. Hermann, M. D., 309 York street, New Haven, Conn.
Atkinson, Kathleen, 287 Clermont avenue, Brooklyn, N. Y.
Avery, Sibyl Howe, Bay Side, Warwick, R. I.
Babbitt, James A., Haverford College, Haverford, Pa.
Babcock, Maud May, 48 West Temple street, Salt Lake City, Utah.
Bacon, Lewis H., 65 Wareham street, Boston, Mass.
Badger, J. E., Springfield, Mass.
Baer, Clara G., 1532 Washington avenue, New Orleans, La.

Bainbridge, William S., M. D., 97 Lexington avenue, New York, N. Y.
Baker, L. K., M. D., 1257 Euclid avenue, Cleveland, O.
Ball, W. H., Jr., Y. M. C. A., Montreal, Can.
Ballard, Mary Wood, 1508 Willington street, Philadelphia, Pa.
Ballard, Clara E. S., 1319 N. 15th street, Philadelphia, Pa.
Ballin, Hans, State Normal University, Carbondale, Wis.
Ballintine, Harriet Isabel, Vassar College, Poughkeepsie, N. Y.
Bancroft, Jessie H., Director Physical Training, Public Schools, Brooklyn, N. Y.
Bangs, Louis A., 48 West 47th street, New York, N. Y.
Baright, Herbert E., M. D., Poughkeepsie, N. Y.
Barker, Alexander E. W.
Barnes, Martha McC., Waltham, Mass.
Barnjum, Helen O., McGill University, Montreal, Can.
Barrows, Elizabeth B., The Western, Oxford, O.
Barrows, Mabel H., 51 Sawyer avenue, Dorchester, Mass.
Bartlett, Bertha L., 1541 Bourier street, Philadelphia, Pa.
Bartlett, E. P., Sunapee, N. H.
Bartlett, R. E., Jr., Y. M. C. A. Training School, Springfield, Mass.
Bates, M. Elizabeth, Bryn Mawr College, Bryn Mawr, Pa.
Bauer, Pauline M., Director Ladies' Gymnastic University of Wisconsin, Madison, Wis.
Beiderhase, Josephine, 138 W. 104th street, New York, N. Y.
Bemis, Blanche A., 581 Cambridge street, Allston, Mass.
Bennett, Gazella, Perkins Institute, South Boston, Mass.
Berenson, Senda, Smith College, Northampton, Mass.
Berthold, John L., Reformatory, Elmira, N. Y.
Bettle, Edward, Jr., 514 Walnut street, Philadelphia, Pa.
Von Beust, Theodore, M. D., New Albany, Ind.
Beyer, Henry G., Ph. D., M. D., U. S. Naval Academy, Annapolis, Md.
Bigelow, Capt. John, Jr., Massachusetts Institute of Technology, Boston, Mass.
Bisbee, J. B., Riverview Academy, Poughkeepsie, N. Y.
Bishop, Mrs. Emily M., Chautauqua, N. Y.
Bissell, Kathryn L., 36 West 93d street, New York, N. Y.
Bissell, Mary T., M. D., 26 West 47th street, New York, N. Y.
Bissett, Florence G., Berkeley, Mass.
Black, Jotham F., Y. M. C. A., Williamsport, Pa.
Blackwell, Helen L., 12 Somerset street, Boston, Mass.
Blake, Clarence J., M. D., 226 Marlborough street, Boston, Mass.
Blake, R. Winifred, Philadelphia Normal School for Girls, Philadelphia, Pa.
Blakiston, Mrs. Kenneth M., Haverford, Pa.
Blakiston, Kenneth M., 1012 Walnut street, Philadelphia, Pa.
Bliss, Miss E. F., Providence, R. I.
Blood, Inez J., 5 Tilley street, New London, Conn.
Boas, Franz, Ph. D. 123 West 82d street, New York, N. Y.
Boice, Francis, 102 N. 19th street, Philadelphia, Pa.

Boice, H. B., M. D., State Normal School, Trenton, N. J.
Bolin, Jakob, 70 East 94th street, New York, N. Y.
Bolin, Miss Sigrid, 70 East 94th street, New York, N. Y.
Bond, T. P., Central Y. M. C. A., 153 La Salle street, Chicago, Ill.
Bond, Sarah A., M. D., 333 Lamartin street, Jamaica Plain, Mass.
Boos, Herman J., Massachusetts Institute Technology, Boston, Mass.
Bowen, W. P., 10 S. University avenue, Ann Arbor, Mich.
Boynton, Frances N., 16 Lewis street, Lockport, N. Y.
Brackett, E. G., M. D., 133 Newbury street, Boston, Mass.
Bradford, E. H., M. D., 133 Newbury street, Boston, Mass.
Bradford, Sophie Barstow, 24 Meeting street, Providence, R. I.
Brede, Chas. F., 144 West Coulter street, Germantown, Pa.
Broaddus, Alice Virginia, Champaign, Ill.
Brobeck, J. G., Hamilton, N. Y.
Brown, Arthur W., Y. M. C. A., Meriden, Conn.
Brown, Frank E., Willamette University, Salem, Ore.
Brown, Harry, 14 Belle Vue Lawn, Leeds, Eng.
Brunner, Helen, 167 Brainard street, Detroit, Mich.
Buckman, Eugene, Penn Valley, Pa.
Bull, Louis A., M. D., 665 West Ferry street, Buffalo, N. Y.
Burbank, Ella L., Brimmer School, Boston, Mass.
Burnham, Stella M., 286 Brush street, Detroit, Mich.
Bursley, C. M., Y. M. C. A. Training School, Springfield, Mass.
Cabot, Caroline A., M. D., 168 W. 48th street, New York, N. Y.
Call, Emma L., M. D., 42 Newbury street, Boston, Mass.
Callowhill, Gulli J., "The Copley," 18 Huntington avenue, Boston, Mass.
Canfield, Ellen B., Cornell University, Ithaca, N. Y.
Cann, F. H., Physical Director, University City of New York, New York, N. Y.
Carey, Charles H., Y. M. C. A. Training School, Springfield, Mass.
Carter, Franklin, LL. D., Williams College, Williamstown, Mass.
Carter, Marien F., Dr. Savage's Gymnasium, New York, N. Y.
Case, Frances E., 1527 Pine street, Philadelphia, Pa.
Caswell, C. E., Y. M. C. A., Houston, Texas.
Centervall, Ivan A., 61 Dartmouth street, Boston, Mass.
Chamberlain, Lucia S., 24 Erie street, Cambridge, Mass.
Channing, Walter, M. D., Brookline, Mass.
Chaplin, Mabel C., 98 Waltham street, Boston, Mass.
Chase, H. Lincoln, M. D., Brookline, Mass.
Chase, Mabel Holkins, Flushing, L. I.
Clark, Cora B., State Normal School, Shippensburg, Pa.
Clark, Hattie M., 271 McDonough street, Brooklyn, N. Y.
Clark, Robt. A., M. D., University of Nebraska, Lincoln, Neb.
Clarke, Elizabeth Lawrence (Mrs.), Williams College, Williamstown, Mass.
Clarke, Grace Tileston, 93 Warren street, Roxbury, Mass.
Close, Geo. H., Y. M. C. A., Ottawa, Can.
Coburn, Kate Van R., 117 Park street, New Haven, Conn.

Coe, Helen L., 450 Cumberland street, Portland, Me.
Colby, Jennie M., 11 Newbury street, Boston, Mass.
Collin, C. O. Lewis, 9 Appleton street, Boston, Mass.
Collins, John A., 43 Euclid avenue, Detroit, Mich.
Conant, William H., M. D., 252 Newbury street, Boston, Mass.
Connor, Mary G., 40 Dwight street, New Haven, Conn.
Cook, Frank A., 16 Taylor street, Providence, R. I.
Coop, William L., Narragansett Machine Co., Providence, R. I.
Corey, Wm. H., 11 Stone street, Charlestown, Mass.
Corey, Alberta Josephine, Oberlin College, Oberlin, O.
Cornish, Harry S., Knickerbocker Athletic Club, New York, N. Y.
Curtiss, Frank H., Suffield, Conn.
Cushman, Florence, St. Agnes School, Albany, N. Y.
Cutter, Alice M., 9 Auburn Place, Brookline, Mass.
Darby, Miss Weltha A., 1134 Case avenue, Cleveland, O.
Davis, Neele, 10 Tuscola street, Detroit, Mich.
Day, W. E., Y. M. C. A., Dayton, O.
Dean, Miss Ninon C., 33 Lake Place, New Haven, Conn.
Deane, Eleanor R., St. Botolph Gymnasium, 194 Clarendon street, Boston, Mass.
DeCamp, Mary A., Boonton, N. J.
DeGroot, Edward B., Montclair, N. J. P. O. Box 280.
Delano, Alice L., 252 Marlborough street, Boston, Mass.
Denman, W. V., 796 State street, Springfield, Mass.
Dickinson, W. B., Y. M. C. A., Albany, N. Y.
Dietz, H. L., Jr.
Dithridge, Louisa May, 2272 Bathgate street, Fordham, N. Y.
Dodds, S. W., M. S., 2826 Washington avenue, St. Louis, Mo.
Dodge, F. H., Chicago Athenaeum, Chicago, Ill.
Doehla, Adam, 216 Shaw avenue, McKeesport, Pa.
Doldt, John E., Director Providence Athletic Club Gymnasium, Providence, R. I.
Donnelly, Mrs. M. J., 180 Warren street, Brooklyn, N. Y.
Doolittle, Fred J., Dr. Holbrook's Military School, Sing Sing, N. Y.
Doran, W. M., 144 Grove street, New Haven, Conn.
Dowd, D. L., 9 East 14th street, New York, N. Y.
Dudley, Gertrude, 22 Elm street, New Haven, Conn.
Durand, Wm. B., Y. M. C. A., Buffalo, N. Y.
Dutcher, Louise E., 117 Gates avenue, Brooklyn, N. Y.
Earle, Marian L., Assistant Physical Supervisor, City Hall, Providence, R. I.
Easton, Grace J., 129 Broadway, New York, N. Y.
Eaton, Katherine E., Durant Gymnasium, Boston, Mass.
Eberhard, Christian, 4325 Washington street, Boston, Mass.
Edmands, Col. Thomas F., 19 Brimmer street, Boston, Mass.
Edwards, Mary, Asheville Female College, Asheville, N. C.
Ehinger, Mrs. C. E., West Chester, Pa.

Ehinger, C. E., M. D., State Normal School, West Chester, Pa.
Ehler, George W., Y. M. C. A. Training School, Chicago, Ill.
Egbert, Eva, Franklin, Pa.
Eger, Franz, Turnverein, Springfield, Mass.
Eliot, John F., 48 Gordon avenue, Hyde Park, Mass.
Elkinton, Thomas, 400 South 9th street, Philadelphia, Pa.
Elliott, Delia M., Berkeley Ladies' Athletic Club, New York, N. Y.
Ells, Harriet B., Vassar College, Poughkeepsie, N. Y.
Elsom, J. C., M. D., University of Wisconsin, Madison, Wis.
Emery, Jessie Fremont, 24 Columbia street, Dorchester, Mass.
Enebuske, Claes J., Ph. D., M. D., 9 Appleton street, Boston, Mass.
Erickson, Josephine S., 15 Albemarle street, Boston, Mass.
Exner, Max J., Carleton College, Northfield, Minn.
Faires, Randolph, M. D., 2007 Walnut street, Philadelphia, Pa.
Felker, Gertrude, Rockford College, Ill.
Finkelday, Frederick A., 218 Walnut street, Philadelphia, Pa.
Fisher, Laura, 68 Marlborough street, Boston, Mass.
Fitz, G. W., M. D., 11 Claverly Hall, Cambridge, Mass.
Flagler, Frances H., 676 Green avenue, Brooklyn, N. Y.
Flattery, Prof. Maurice D., Center College, Danville, Ky.
Fleming, Belle, Lock Haven, Pa.
Foglesong, Nellie A., 327 E. Main street, Dayton, O.
Foley, Anna G., 26 Mulberry street, Worcester, Mass.
Folger, Grace E., New York, N. Y.
Ford, W. A., M. D., 1420 Chestnut street, Philadelphia, Pa.
Foster, Alice B., M. D., Bryn Mawr, Pa.
Foster, Festus H., Jr., 53 Union street, Springfield, Mass.
Foster, Ralph E., Trinity College, Hartford, Conn.
Fowler, Miss T. S., New Haven, Conn.
Frothingham, Helen H., Y. W. C. A., Brooklyn, N. Y.
Gabler, G. L., Y. M. C. A., Bridgeport, Conn.
Garland, Josephine B., 111 Appleton street, Boston, Mass.
Garside, Martha, 28 So. Clinton street, East Orange, N. Y.
Gebhardt, Henry.
Gibbs, Edith M., Box 279, Foxborough, Mass.
Gibbson, John T., Agassiz School, Jamaica Plain, Mass.
Gilley, Frank M., 100 Clark avenue, Chelsea, Mass.
Goldie, George, Princeton, N. J.
Goldsmith, Carrie, Sanatory Gymnasium, Park avenue, Cincinnati, O.
Googins, Clinton H., 796 State street, Springfield, Mass.
Gray, Isa G., 421 Marlborough street, Boston, Mass.
Greene, Alma L., Chestnut, corner Hall street, Waltham, Mass.
Greene, Mary E., South Manchester, Conn.
Greenleaf, R. W., M. D., 561 Boylston street, Boston, Mass.
Greenwald, James A., Y. M. C. A. Training School, Springfield, Mass.
Griller, A., Newark, N. J.
Grogan, Annie M., Stanton avenue, East Liberty, Penn.

Guild, G. F., Brimmer School. Boston, Mass.
Guion, Francis D., Elmira College, Elmira, N. Y.
Gulick, Luther, M. D., Springfield, Mass.
Gwathemey, James T., M. D., Vanderbilt University, Nashville, Tenn.
Haight, Maude D., 99 Howe street, New Haven, Conn.
Hall, Carolyn Ladd, M. D., Haverford, Pa.
Halstead, Alfred T., M. D., Springfield, Mass.
Hamaker, Ida R., 406 West 57th street, New York, N. Y.
Hamilton, Sarah E., West Broad street, Chester, Pa.
Hammett, Chas. Edw., Thurmont, Md.
Hanchett, Annie, 9 Appleton street, Boston, Mass.
Hand, C. W., 99 Howe street, New Haven, Conn.
Hanna, Delphine, M. D., Oberlin College, Oberlin, O.
Hanus, Prof. Paul H., 5 Walker street, Cambridge, Mass.
Harper, Ruth A., New Britain, Conn.
Hartwell, E. M., M. D., Ph. D., 5 Brimmer street, Boston, Mass.
Harvey, Fred'k James, 70 St. Sidwell's, Exeter, Devonshire, Eng.
Harvey, Janet, 112 Pembroke street, Boston, Mass.
Hasie, George E.
Haskell, C. E., Physical Director Y. M. C. A., San Antonio, Tex.
Haug, Emmanuel, 103 Water street, Springfield, Mass.
Hazen, Charles M., 1001 Main street, Richmond, Va.
Hazen, Charlotte, Auburndale, Mass.
Healey, Frances, 765 Main street, Worcester, Mass.
Hecker, Effie M., Miamisburg, O.
Hellrung, A., Hotel Imperial, New York, N. Y.
Helmreich, Frederick W., Denver Athletic Club, Denver, Col.
Henay, Frances A., N. E. Conservatory of Music, Boston, Mass.
Hewins, Annie J., High street, Dedham, Mass.
Heyworth, Edith E., Providence, R. I.
Hibbert, Oliver L., Y. M. C. A., Providence, R. I.
Hicks, Mrs. Mary Dana, 7 Park street, Boston, Mass.
Higgins, Henry A., 199 Marion street, East Boston, Mass.
Hill, Edith L., Director Woonsocket Schools, 88 Blackstone street, Woonsocket, R. I.
Hill, Lucile E., Wellesley College, Wellesley, Mass.
Hilliard, Elizabeth P., 668 Tremont street, Boston, Mass.
Hills, Katherine L., 844 Main street, Hartford, Conn.
Hinckley, Augusta, 144 Ramsen street, Brooklyn, N. Y.
Hitchcock, E., M. D., Sr., Amherst College, Amherst, Mass.
Hitchcock, E., M. D., Jr., Cornell University, Ithaca, N. Y.
Holbrook, M. L., M. D., 46 E. 21st St., New York, N. Y.
Holman, Frank H., Y. M. C. A., Kingston, Ont.
Holmstrom, Vendla M., Posse Gymnasium, Boston, Mass.
Holt, Jacob F., M. D., 1935 Poplar street, Philadelphia, Pa.
Homans, Amy Morris, 9 Appleton St., Boston, Mass.
Hopkins, Maude G., Drexel Institute, Philadelphia, Pa.

Horton, Clara J., 612 12th street, N. W., Washington, D. C.
Hoskins, Geo. W., State College, Center county, Pa.
Houghton, Bessie Marie, Hotel Oxford, Boston, Mass.
Hovey, Marien, 100 Beacon street, Boston, Mass.
Howe, Elsie, M. D., Smith College, Northampton, Mass.
Howland, John A., Boys' High School, Providence, R. I.
Howell, Helen P., 24 Linden Place, Brookline, Mass.
Howell, Mary H., Southold, Suffolk county, N. Y.
Hoxie, Maude G., Knoxville, Tenn.
Hubbard, Charles W., 133 Essex street, Boston, Mass.
Hubbard, Mary, "The Warren," Roxbury, Mass.
Hudders, Mrs. Etta Morse, 308 Lewis avenue, Brooklyn, N. Y.
Hughes, Miss Annie R., Garretford, Pa.
Hughes, Laura A. C., M. D., 437 Boylston street, Boston, Mass.
Huling, Ray Greene, 101 Trowbridge street, Cambridge, Mass.
Humpston, Miss Millicent, 547 West Front street, Plainfield, N. J.
Huntley, Mrs. Emma Manning, 248 Branch street, Lowell, Mass.
Ireson, Jennie E., 185 West Canton street, Boston, Mass.
Ives, Bertha J., 147 Quinnipiac street, Fair Haven, Conn.
Jackson, Henry Chester, Phillips Academy, Exeter, N. H.
Jackson, W. A., Jr., Baltimore, Md., Box 256.
Jacob, Anna Gertrude, State Normal School, South Manchester, Conn.
Jacobs, Sarah J., 1515 Georgie Bell street, Los Angeles, Cal.
Janney, Hannah H., 1807 Bolton street, Baltimore, Md.
Jennings, Mary Kirby, 43 West street, South Norwalk, Conn.
Johnson, Boone V. H., 247 Greenwich avenue, New Haven, Conn.
Johnson, Daisy, Memphis, Tenn.
Johnson, Fanny L., Kindergarten for the Blind, Jamaica Plain, Mass.
Johnson, Herbert S., M. D., Lawrenceville, N. J.
Johnson, Theodore G., 48 Concord avenue, Boston, Mass.
Jones, Mrs. Mary E. W., Everett, Mass.
Jones, Mary M., 1710 Chestnut street, Philadelphia, Pa.
Jones, Margaret, Girls' Sanatory Gymnasium, Cambridge, Mass.
Jordan, Ella C., 178 Newbury street, Horace Mann School, Boston, Mass.
Joslin, Alice B., 12 Enfield street, Jamaica Plain, Mass.
Joslin, W. C., Staten Island Academy, Stapleton, N. Y.
Joy, F. Maude, 27 Massachusetts avenue, Boston, Mass.
Judson, Anna G., 611 Whitney avenue, New Haven, Conn.
Kallenberg, Henry, Y. M. C. A., State University, Iowa City, Ia.
Kellogg, J. H., M. D., Battle Creek, Mich.
Killan, Frank, Y. M. C. A. Training School, Springfield, Mass.
Kimberlin, Nettie D., 78 Elizabeth street, Detroit, Mich.
Kindervater, A. F., 1508 Chauteau avenue, St. Louis, Mo.
King, Myrtle E., 39 Washington avenue, Detroit, Mich.
Kinnicutt, William H., Y. M. C. A. Building, Cleveland, O.
Kite, Rebecca, 3322 Hamilton street, Philadelphia, Pa.
Knapp, Jno. B., 62 W. 51st street, New York, N. Y.

Kroh, Karl J., Cook County Normal School, Englewood, Chicago, Ill.
Kuhn, Esther, 429 Green street, Philadelphia, Pa.
Kuhn, Miriam, 429 Green street, Philadelphia, Pa.
Kurtz, Elizabeth S., 273 Chaplain street, Detroit, Mich.
Lambeth, W. A., M. D., University of Virginia, Charlottesville, Va.
Landon, Capt. T. D., Military Institute, Bordentown, N. J.
Laughton, Sarah E., 364 Massachusetts avenue, Boston, Mass.
Lawrence, Mrs. Margaret Stanton, 26 W. 61st street, New York, N. Y.
Lee, Granville R., Athletic Club, Portland, Me.
Lee, Nina M., 317 E. State street, Trenton, N. J.
LeGarde, Ellen, Phys. Dir. Schools, 10 Mawney street, Providence, R. I.
Leonard, F. E., M. D., Oberlin College, Oberlin, O.
Liebold, Anton, 345 E. Kossuth street, Columbus, O.
Lincoln, D. F., M. D., 73 Pinckney street, Boston, Mass.
Lindley, E. Marguerite, Murray Hill Hotel, New York city, N. Y.
Lines, Jessie A., 344 Washington avenue, Brooklyn, N. Y.
Little, Lena B., 26 Montgomery street, Newburgh, N. Y.
Locke, Mary S., 103 Pinckney street, Boston, Mass.
Longstreth, Wm. W., 505 Pine street, Philadelphia, Pa.
Ludlam, Mrs. Mary Hogan, 2900 A Lucas avenue, St. Louis, Mo.
Lutz, John W., Y. M. C. A., Wichita, Kan.
Lyman, Herbert, 1671 Cambridge street, Cambridge, Mass.
Lyon, Edwin P., City Hall, New Haven, Conn.
McBurney, R. R., 40 E. 23d street, New York, N. Y.
McCurdy, J. H., M. D., Y. M. C. A., 23d street, New York, N. Y.
McDuffie, Anna S., Bradford, Vt.
McIntire, Charles, Jr., M. D., 104 N. 4th street, Eaton, Pa.
McKee, W. Earl.
McKenzie, B. E., M. D., 14 W. Bloor street, Toronto, Can.
McKenzie, R. Tait, M. D., McGill University, Montreal, Can.
McMartin, Elizabeth, Mt. Vernon, N. Y.
Maccarty, Martha E., 1612 Green street, Philadelphia, Pa.
Magee, Walter Edmund, University of California, Berkeley, Cal.
Marshall, Alice, 25 Lynwood street, New Haven, Conn.
Marshall, Mary Tylden, 2017 Wallace street, Philadelphia, Pa.
Martin, Eva May, 231 S. Jefferson street, Dayton, O.
Martin, Rufus J., Y. M. C. A. Training School, Springfield, Mass.
Martin, W. H., Cooperstown, N. Y.
Mason, L. Julius, Y. M. C. A. Training School, Springfield, Mass.
Mathews, Clara A., 127 Prospect place, Brooklyn, N. Y.
Maxwell, Juliet, A. B., Indiana University, Bloomington, Ind.
May, Eva G., Vassar College, Poughkeepsie, N. Y.
Mayhew, Abbie S., Y. W. C. A., Minneapolis, Minn.
Mead, Tilson A., 32 Monmouth street, East Boston, Mass.
Mellen, E. S., 9 Forest street, North Cambridge, Mass.
Messer, Louis Adolphus, Y. M. C. A. Training School, Springfield, Mass.
Metcalf, Alice, Fredericksburg, Va.

Metzner, Henry, 212 E. 83d street, New York, N. Y.
Mickle, Maud M., 328 Ashland avenue, Buffalo, N. Y.
Miller, Sarah E., Girls' High School, Boston, Mass.
Moberg, Anna, 20th street and James avenue, Boston, Mass.
Molineux, Gen. E. L., 117 Fort Greene Place, Brooklyn, N. Y.
Monohan, Otto F., Trinity School, W. 91st street, New York, N. Y.
Montezuma, Carlos, M. D., Indian School, Carlisle, Pa.
Moody, F. S., New London, Conn., P. O. Box 863.
Moody, Mary B., M. D., Fair Haven Heights, Conn.
Moon, Schuyler B., McDonogh School, McDonogh, Md.
Moore, Henrietta, 117 Edmund Place, Detroit, Mich.
Morril, Charlotte J., 16 Franklin street, Providence, R. I.
Morris, Anna R., 564 Prospect street, Cleveland, O.
Morse, Adelaide, 237 York street, New Haven, Conn.
Morse, Francis A., 120 Corey street, West Roxbury, Mass.
Morton, Pauline, M. D., Sanatory Gymnasium, Rochester, N. Y.
Mosher, Eliza M., M. D., University of Michigan, Ann Arbor, Mich.
Moulton, Edward S., M. D., 1825 Chestnut street, Oakland, Cal.
Muller, Lucie Bianca, Chattanooga, Tenn.
Mulliner, Mary R., 156 West Newton street, Boston, Mass.
Munger, Miss E. Van A., 218 Washington avenue, Brooklyn, N. Y.
Murdock, F. F., Bridgewater Normal, Bridgewater, Mass.
Murray, Henrietta A., 66 Jacques avenue, Worcester, Mass.
Myers, Harry C., Wooster University, Wooster, O.
Narey, Hope W., Y. W. C. A. Gymnasium, Boston, Mass.
Newcomb, Lydia J., Moravian Seminary, Bethlehem, Pa.
Nichol, Martha L., 620 Madison street, Toledo, O.
Norris, John O., Melrose, Mass.
Noyes, Frances S., Dansville, N. Y.
Nye, Jane, 21 E. 8th street, Cincinnati, O.
Oliver, Henry K., M. D., The Union Club, Boston, Mass.
Oller, Lawrence A., Y. M. C. A., corner 7th street and Penn. avenue, Pittsburgh, Pa.
Oothout, Augusta, Higbee School, Memphis, Tenn.
Otis, Edward O., M. D., 308 Commonwealth avenue, Boston, Mass.
Otto, Henry Ladd, Y. M. C. A. Training School, Springfield, Mass.
Owen, Amelia L., 66 Marlborough street, Boston, Mass.
Page, Nina A., 9 Appleton street, Boston, Mass.
Page, P. S., Y. M. C. A. Training School, Springfield, Mass.
Paget, Capt. Joseph T., 11 Beale street, Dorchester, Mass.
Parke, Katherine, New Haven, Conn.
Parker, Col. Francis W., 6640 Honore street, Englewood, Ill.
Parker, Fred. W., Instructor Gym., Brown University, Providence, R. I.
Parks, Frederick T., 19 Congress street, Boston, Mass.
Parry, Eleanor, M. D., Infant Asylum, 61st street and Amsterdam avenue, New York, N. Y.
Parsons, Winifred E., Oneonta, N. Y.

Peck, Katherine B., 16 W. 9th street, New York, N. Y.
Peckham, Ellery G., Y. M. C. A., Stamford, Conn.
Perrin, Ethel, West Newton, Mass.
Perry, Frank J., Providence, R. I.
Pertuch, Richard, 3137 Westmont street, Philadelphia, Pa.
Peter, F. J., 13th street and James avenue, Boston, Mass.
Peterson, Ellis, 305 Chestnut avenue, Jamaica Plain, Mass.
Pettit, H. S., M. D., Adelphi Academy, Brooklyn, N. Y.
Pfister, Franz, M. D., 731 Third street, Milwaukee, Wis.
Phillips, Paul C., Young Men's Institute, New York, N. Y.
Pierce, J. M., 2 Bellevue avenue, North Cambridge, Mass.
Pierpont, Lucy, Waterbury, Conn.
Plant, John W.
Plummer, Laura S., 120 Princeton street, East Boston, Mass.
Poley, Miss G. S., Norristown, Pa.
Pollard, David W., Y. M. C. A., Pawtucket, R. I.
Pomeroy, Mary W., 118 W. 69th street, New York, N. Y.
Poole, George F., M. D., School Christian Workers, Springfield, Mass.
Porter, William Townsend, M. D., 295 Beacon street, Boston, Mass.
Posse, Mrs. Rose, 23 Irvington street, Boston, Mass.
Potter, Mary G., Adelphi Academy, Brooklyn, N. Y.
Powter, C. B., Y. M. C. A. Training School, Springfield, Mass.
Pratt, Frederic B., Pratt Institute, Brooklyn, N. Y.
Prentios, Lory, Newark Academy, Newark, N. J.
Pretat, Eleanor Earl, 29 Liberty street, Waterbury, Conn.
Price, Charles Herbert, 796 State street, Springfield, Mass.
Rabethge, C. A., M. D., Y. M. C. A., Boston, Mass.
Rand, Carrie, Iowa College, Grinnell, Ia.
Ransom, Miss M. E., Lasell Seminary, Auburndale, Mass.
Razerelli, Paul C. De, Athletic Club, Pueblo, Col.
Reach, Robert, 8th street, Philadelphia, Pa.
Reeve, J. C., M. D., Wilkinson and Third streets, Dayton, O.
Reiff, Mame J., Normal School, Kutztown, Pa.
Remy, F. W., Y. M. C. A., Mansfield, O.
Richards, Anna, 315 York street, New Haven, Conn.
Richards, Prof. E. L., Yale University, New Haven, Conn.
Rideout, M. D., 14 Rue de Trévise, Paris, France.
Riedel, Adolph, 221 Myrtle street, Baltimore, Md.
Riel, Ida V., M. D., Chestnut street, Coatesville, Pa.
Robb, Miss N. Rebecca, 305 Gilpin avenue, Wilmington, Del.
Rontzahn, E. G., Y. M. C. A., Dayton, O.
Ross, Maurice, Y. M. C. A. Training School, Springfield, Mass.
Rossiter, Louise Webster, 45 Upton street, Boston, Mass.
Ruble, Caroline Alfarata, 52 North avenue, A, Canton, Ill.
Ruggles, E. P., Y. M. C. A. Training School, Springfield, Mass.
Russell, E. Harlow, State Normal School, Worcester, Mass.
Russell, Miss L. S., 13 Woodville Park, Roxbury, Mass.

Ryder, Josiah P., Drexel Institute, Philadelphia, Pa.
Sackett, Harriet S., Pratt Institute, Brooklyn, N. Y.
Salmon, Isabell, Ogden, Utah.
Sanborn, Frances S., Mt. Holyoke College, South Hadley, Mass.
Sanborn, Lura W., Y. W. C. A., Providence, R. I.
Sargent, Dudley A., M. D., Hemenway Gymnasium, Cambridge, Mass.
Saulsbury, Amanda D., Walters Park, Pa.
Savage, W. L., M. D., 308 West 59th street, New York, N. Y.
Sawtelle, Ellen C., Hancock School, Boston, Mass.
Sawyer, H. L., Bennett School, Boston, Mass.
Scales, Carrie L., Newton, Mass.
Scarborough, Emily B., 26 Hart street, New Britain, Conn.
Schaeffer, Edward M., M. D., 2024 Park avenue, Baltimore, Md.
Scharff, Violette E., 2013 Indiana avenue, Chicago, Ill.
Schetke, Mary E., 4815 Fairmount avenue, Philadelphia, Pa.
Schlesinger, B., 131 Devonshire street, Boston, Mass.
Schmitt, Louis, 135 Paul Gore street, Jamaica Plain, Mass.
Schulz, C. F. E., 1102 Myrtle avenue, Baltimore, Md.
Sears, Mrs. Edmund, care of E. H. Sears, Mary Institute, St. Louis, Mo.
Seaver, Mrs. Jay W., 25 Linwood street, New Haven, Conn.
Seaver, Jay W., M. D., Yale University, New Haven, Conn.
Seerley, F. N., M. D., Instructor Y. M. C. A. Training School, Springfield, Mass.
Seward, O. P., Y. M. C. A., Elgin, Ill.
Shaffer, Anna, 568 Chapel street, New Haven, Conn.
Shanahan, Rev. J. W., 48th street and Lancaster avenue, Philadelphia, Pa.
Slocum, Benita V., 220 Blatchley avenue, New Haven, Conn.
Small, May D., 812 Girard Building, Philadelphia, Pa.
Smedley, Caroline W., 4661 Penn street, Frankford, Pa.
Smedley, Emily C., West Chester, Pa., Box 2598.
Smith, Adela J., 45 Westland avenue, Boston, Mass.
Smith, Constantine W., 4 N. 40th street, Philadelphia, Pa.
Smith, Emily Dillman, 426 Clark avenue, Cleveland, O.
Smith, Ella E., Canandaigua, N. Y.
Smith, Fanchon W., 1051 Market street, Oakland, Cal.
Smith, H. L., Y. M. C. A., Galveston, Texas.
Smith, Mrs. Jennie C. R., State Normal School, Mansfield, Pa.
Smith, J. Gardner, M. D., 307 Lenox avenue, corner 125th street, New York, N. Y.
Smith, Joseph I., M. D., 207 N. 5th street, Philadelphia, Pa.
Smith, Louisa, 138 Holland street, Syracuse, N. Y.
Smith, Mary Sears, 41 Hempstead street, New London, Conn.
Snow, Minnie B., 158 E. 124th street, New York, N. Y.
Solomon, Emily J., Huguenot Seminary, Wellington, South Africa.
Spicer, Margaret R., Winchester, Mass.
Spiegle, Grace E., 2115 N. 13th street, Philadelphia, Pa.
Spiller, Adolph, 204 Ferry street, Newark, N. J.

Stagg, A. Alonzo, University of Chicago, Chicago, Ill.
Stahley, G. D., M. D., Pennsylvania College, Gettysburg, Pa.
Stanton, Jennie B., 8 Spring street, Westerly, R. I.
Stecher, William A., 1830 Papain street, St. Louis, Mo.
Steger, Bessie, Bonham, Texas.
Stoneroad, Rebecca, 1123 13th street, Washington, D. C.
Stratton, Sina, 1313 N. 19th street, Philadelphia, Pa.
Streeper, Gertrude M., 111 Walnut street, Philadelphia, Pa.
Sturrock, Alexander, Dundee, Scotland.
Suder, Henry, 1619 Grace street, Chicago, Ill.
Swain, Fremont, M. D., 120 E. 86th street, New York, N. Y.
Swain, Helen Jasper, 16 St. Botolph street, Boston, Mass.
Swinerton, Lenna D., 96 W. Newton street, Boston, Mass.
Symonds, Lucy Harris, 29 Hanson street, Boston, Mass.
Talbot, Mary Eloise, care of P. C. Chase, 28 Lincoln street, Boston, Mass.
Talbot, W. T., M. D., 685 Boylston street, Boston, Mass.
Tarbell, Hon. Horace S., Superintendent Public Schools, Providence, R. I.
Taylor, Frederick W., M. D., 1797 Massachusetts avenue, North Cambridge, Mass.
Taylor, Henry Ling, 201 W. 54th street, New York, N. Y.
Taylor, J. B., Berkeley School, Boston, Mass.
Taylor, S. May, Director Pawtucket Schools, 81 Cedar street, Pawtucket, R. I.
Thayer, Ada F., 1319 E. Genesee street, Syracuse, N. Y.
Theis, Emile C.
Thomas, Edna, Thomaston, Conn.
Thomas, Felicia F., Friends' Boarding School, Westtown, Pa.
Thompson, H. S., 713 Chapel street, New Haven, Conn.
Thurston, Ada, Packer Institute, Brooklyn, N. Y.
Tilden, John N., M. D., Military Academy, Peekskill, N. Y.
Torrey, Cordelia G., 23 Winthrop street, Roxbury, Mass.
Towne, Lillian M., 34 Falmouth street, Boston, Mass.
Trowbridge, Janette, 685 Orange street, New Haven, Conn.
Turner, Ada, Stoughton, Wis.
Turner, Alice W., 1520 Chestnut street, Baker Building, Philadelphia, Pa.
Turner, Anita J., 1818 11th street, Washington, D. C.
Tyson, John M., 116 Linden street, Pittston, Pa.
Upham, Mrs. Ella Prentiss, M. D., 304 Third avenue, Asbury Park, N. J.
Valdes, F. P., Y. M. C. A., Charleston, S. C.
Vaux, George, Jr., Girard Building, Philadelphia, Pa.
Walker, Florence C., St. Margaret's School, Buffalo, N. Y.
Walker, Isabel F., State Normal School, Whitewater, Wis.
Wall, C. F. B., Y. M. C. A. Training School, Springfield, Mass.
Wallace, George W., 80 W. 126th street, New York, N. Y.
Wallace, Margaret S., Newtonville, Mass.
Warner, Bessie Haywood, Florence, Mass.
Watson, H. G., Centreville, Md.
Webster, Mrs. C. B., Netherland Hotel, New York, N. Y.

Weeden, Ethel Rubie, 90 Whalley avenue, New Haven, Conn.
Wegener, A. B., University of Tennessee, Knoxville, Tenn.
Weicksel, Amelia, Washington, D. C.
Wells, Anna D. McNair, Auburndale, Mass.
Welzmiller, Louis, Jr., Y. M. C. A., 312 86th street, New York, N. Y.
Went, Harvey C., Director Physical Education, Public Schools, Bridgeport, Conn.
West, Mrs. Emma Carter, 9 Wilson street, Winchester, Mass.
Weston, George F., Principal Manual Training High School, Providence, R. I.
Wettervik, Filip, 222 Lexington avenue, New York, N. Y.
Wey, H. D., M. D., State Reformatory, Elmira, N. Y.
White, Flora J., 94 Huntington avenue, Boston, Mass.
White, Mary A., 94 Huntington avenue, Boston, Mass.
Whittier, F. N., M. D., Bowdoin College, Brunswick, Me.
Wiggins, Alta, 254 E. Third street, Salt Lake City, Utah.
Wilbur, Helen L., 12 School street, East Providence, R. I.
Williams, Alice M., 43 Ingell street, Taunton, Mass.
Wilson, Almira J., 54 Berkeley street, Boston, Mass.
Wilson, Jennie B., Sanatory Gymnasium, Cambridge, Mass.
Wilson, M. Caroline, Nonantum Gymnasium, Newton, Mass.
Winter, Magnus F., Turnverein, Jersey City, N. J.
Wolcott, Grace, M. D., 68 Marlborough street, Boston, Mass.
Wood, T. D., M. D., Leland Stanford University, Palo Alto, Cal.
Wright, Elizabeth A., Smith College, Northampton, Mass.
Wright, Elizabeth M., 627 College avenue, Pittsburg, Pa.
Young, A. G., M. D., Augusta, Me.
Young, Evaline, Girls' High School, 2046 Park avenue, Philadelphia, Pa.
Young, H. Alfred, Oberlin, O., P. O. Box 14.
Zapp, August, M. D., 488 N. Hayne avenue, Chicago, Ill.
Ziegler, Carl, M. D., 532 Bishop street, Cincinnati, O.

BRANCH ORGANIZATIONS OF THE A. A. A. P. E.

The following branch societies have organized or are in process of organization as stated in connection with each (July 1, 1896):

SECTIONS.

None are yet formed.

DISTRICTS.

OHIO.—Organized March 30, 1895. Annual meeting held November 29 and 30, 1895.

President, F. E. Leonard, M. D.
Vice-President, Carl Zeigler.
" W. H. Kinnicutt.
Secretary, R. Anna Morris.
Treasurer, W. E. Day.

CONNECTICUT.—Organized April 29, 1896.

President, Jay W. Seaver, M. D.
Vice-President, Hermann Arnold, M. D.
" Emily Scarborough.
Secretary, W. G. Anderson, M. D.
Treasurer, Mr. G. L. Gabler.

PHYSICAL EDUCATION SOCIETIES.—The lists of members of societies whose organizations are complete are given.

BOSTON PHYSICAL EDUCATION SOCIETY.—Organized January 4, 1896.

President, Clarence J. Blake, M. D.
Vice-President, Mrs. Rose Posse.
" F. F. Murdock.
Secretary, Ellis Peterson.
Treasurer, Francis A. Morse.
Council, Hermann J. Boos.
" Tilson A. Mead.
" Laura Fisher.

LIST OF MEMBERS.

Kate L. Adams.
Sibyl Howe Avery.
Capt. John Bigelow, Jr.
Clarence J. Blake, M. D.
Sarah A. Bond, M. D.
Hermann J. Boos.
E. G. Brackett, M. D.
Ivan A. Centervall.
Walter Channing, M. D.
Mabel C. Chaplin.
H. Lincoln Chase, M. D.
Jennie M. Colby.
William H. Conant, M. D.
Wm. H. Corey.

Alice L. Delano.
Christian Eberhard.
Col. Thomas F. Edmands.
John F. Eliot.
Claes J. Enebuske, Ph. D., M. D.
Josephine S. Erickson.
Laura Fisher.
George W. Fitz, M. D.
Josephine B. Garland.
Edith M. Gibbs.
Isa G. Gray.
R. W. Greenleaf, M. D.
Prof. Paul H. Hanus.
E. M. Hartwell, Ph. D., M. D.
Janet Harvey.
Charlotte Hazen.
Francis Healey.
Frances A. Henay.
Henry A. Higgins.
Elizabeth P. Hilliard.
Amy Morris Homans.
Helen P. Howell.
Charles W. Hubbard.
Mary Hubbard.
Laura A. C. Hughes.
Ray Greene Huling.
Fanny L. Johnson.
Theodore G. Johnson.
Ella C. Jordan.
Alice B. Joslin.
F. Maude Joy.
D. F. Lincoln, M. D.
Mary S. Locke.
Herbert Lyman.
Francis A. Morse.
Mary Mulliner.
John O. Norris.
E. O. Otis, M. D.
Amelia L. Owen.
Capt. Joseph T. Paget.
Frederick T. Parks.
F. J. Peter.
Ellis Peterson.
J. M. Pierce.
Laura S. Plummer.
Mrs. Rose Posse.
Laura S. Russell.
Dudley A. Sargent, M. D.
Carrie L. Scales.
Margaret R. Spicer.
Lenna D. Swinerton.
Lucy Harris Symonds.
Mary Eloise Talbot.
W. T. Talbot, M. D.
Frederick W. Taylor, M. D.
J. B. Taylor.
Lillian M. Towne.
Flora J. White.
Mary A. White.
Grace Wolcott, M. D.

BRIDGEPORT PHYSICAL EDUCATION SOCIETY.

President, G. L. Gabler, Jr.
Vice-President, Benita V. Slocum.
" Fred Kuettner.
Secretary, Harvey C. Went.
Treasurer, Grace M. Bronson.

CHICAGO PHYSICAL EDUCATION SOCIETY is in process of organization under the direction of the following committee:

Karl Kroh.
Dr. Phillips.
Mary E. Barnet.
Janet Orr Thompson.
George W. Ehler.

CLEVELAND PHYSICAL EDUCATION SOCIETY.—Organized March 16, 1896.

President, Karl Zapp, M. D.
Vice-President, W. H. Kinnicutt.

Vice-President, R. Anna Morris.
Secretary, Weltha A. Darby.
Treasurer, H. S. Anderson.
Council, E. L. Harris.
" Theo. H. Johnston.
" Mrs. A. P. Tucker.

DETROIT PHYSICAL EDUCATION SOCIETY.—A society is in process of organization (Miss Nettie D. Kimberlin).

NEW HAVEN PHYSICAL EDUCATION SOCIETY.—Organized June 9, 1896.

President, W. G. Anderson, M. D.
Vice-President, E. Hermann Arnold, M. D.
" Anna G. Judson.
Secretary, H. G. Watson.
Treasurer, Bertha J. Ives.

LIST OF MEMBERS.

W. G. Anderson, M. D.
E. Hermann Arnold, M. D.
Kathleen Atkinson.
Frances N. Boynton.
Eugene Buckman.
Mary G. Connor.
Ninon C. Deane.
Gertrude Dudley.
Theodosia S. Fowler.
Sarah E. Hamilton.
C. W. Hand.
Bertha J. Ives.
Anna Judson.
Edward Moulton, M. D.
Jane Nye.
Katherine Parke.
Anna H. Pierpont.
Jay W. Seaver, M. D.
Edna Thomas.
H. G. Watson.
W. M. Doran.
Mrs. J. W. Seaver.

NEW YORK PHYSICAL EDUCATION SOCIETY.—Organized March 2, 1896.

President, Jacob Bolin.
Vice-President, Mary T. Bissel, M. D.
" Ada Thurston.
Secretary, Delia M. Elliot.
Treasurer, Alexander C. Howe.
Council, Nicholas Murray Butler, Ph. D.
" Wm. H. Maxwell.
" Henry Ling Taylor, M. D.

PHILADELPHIA PHYSICAL EDUCATION SOCIETY.—Organized February 15, 1896.

President, Grace E. Spiegle.
Vice-President, Richard Pertuch.
" R. Winifred Blake.

Secretary, Alice B. Foster.
Treasurer, James A. Babbitt.
Council, Joseph S. Smith, M. D.
" Evaline Young.
" Maude G. Hopkins.

LIST OF MEMBERS.

James A. Babbitt.
Mary Wood Ballard.
Bertha L. Bartlett.
R. Winifred Blake.
Mrs. Kenneth M. Blakiston.
Frances E. Case.
Thomas Elkinton.
Alice B. Foster, M. D.
Carolyn Ladd Hall, M. D.
Maude G. Hopkins.
Annie R. Hughes.
Mary M. Jones.
Miriam Kuhn.
Mary Tylden Marshall.
G. S. Poley.
Ida V. Riel.
Mary E. Schetke.
May D. Small.
Emily C. Smedley.
Grace E. Spiegle.
Gertrude M. Streeper.
Alice W. Turner.
Evaline Young.

PROVIDENCE PHYSICAL EDUCATION SOCIETY ("Rhode Island Gymnastic League").—Organized May 9, 1896.

President, Hon. Horace S. Tarbell.
Vice-President, Fred W. Parker.
" John E. Doldt.
Secretary-Treasurer, Marian L. Earle.
Council, George F. Weston.
" S. May Taylor.
" Ellen Le Garde.

LIST OF MEMBERS.

Mabel Allen.
E. F. Bliss.
Frank A. Cook.
Wm. L. Coop.
John E. Doldt.
Marian L. Earle.
Edith E. Heyworth.
Oliver L. Hibbert.
Edith L. Hill.
John A. Howland.
Ellen Le Garde.
Charlotte J. Morril.
Frederick W. Parker.
Frank J. Perry.
Jennie B. Stanton.
Horace S. Tarbell.
S. May Taylor.
Geo. F. Weston.
Helen F. Wilbur.

SPRINGFIELD PHYSICAL EDUCATION SOCIETY ("Western Massachusetts Physical Education Society").—Organized June, 1896.

President, Thomas M. Balliet.
Secretary, George Poole, M. D.
Treasurer, Senda Berenson.

American Association for the Advancement of Physical Education.

Announcement and Appeal by the National Council.

The A. A. A. P. E., at its Tenth Annual meeting, held in New York city April 25–27, 1895, voted to adopt a revised Constitution and By-Laws, which are appended to this circular. Pursuant to a vote of the Association passed April 27, 1895, a convention of the New England members of the Association was held in Boston, May 25, 1895, at which the following-named persons, residents of Massachusetts, were elected members of the National Council of the A. A. A. P. E.: Walter Channing, of Brookline; Christian Eberhard, of Boston; G. W. Fitz, of Cambridge; Edward M. Hartwell, of Boston; Edward Hitchcock, of Amherst; Miss Amy Morris Homans, of Boston; Ray Greene Huling, of Cambridge; Miss Hope W. Narey, of Boston; D. A. Sargent, of Cambridge; and H. J. Boos, Miss Jennie E. Ireson, and Miss Mary E. Allen, of Boston, as first, second, and third substitutes, respectively.

The National Council of the A. A. A. P. E., being duly organized as follows: President, Edward M. Hartwell; Vice-President, Edward Hitchcock; Recording Secretary, Ray Greene Huling; Corresponding Secretary, G. W. Fitz; Treasurer, Christian Eberhard, bespeaks the co-operation of the members of the Association, and of all others interested in the advancement of physical education, in furthering the general objects of the Association, which are these: To awaken a wider and more intelligent interest in Physical Education; to acquire and

disseminate knowledge concerning it; and to labor for the improvement and extension of gymnastics, games, and athletic pastimes in the education of children and youth.

The reorganization of the Association being an accomplished fact, the Council feels called upon to indicate the line of action which it proposes to follow in its efforts to effectuate the objects of the Association. But before announcing its policy the Council desires to call attention to certain facts in the history of the Association, and to the steps taken to bring about its reorganization.

The A. A. A. P. E. was organized on November 27, 1885, at the Adelphi Academy, Brooklyn, N. Y., at a meeting of some sixty persons who came together at the invitation of W. G. Anderson, M.D., of the Adelphi Academy. The second and third meetings were also held at the Adelphi Academy, in Brooklyn, on November 26, 1886, and November 27, 1887, respectively. The fourth annual meeting was held at the Berkeley Lyceum, in New York city, November 30, 1888. The fifth meeting was held at Harvard University, and at Huntington Hall, Boston, April 4 and 5, 1890. The sixth meeting was also held in Boston on April 3 and 4, 1891, at the Young Men's Christian Union. The seventh meeting was held in Philadelphia at the Drexel Institute, April 7 and 8, 1892; and the eighth was held in Chicago at the Art Palace, July 29, 1893. The ninth annual meeting was held at Yale University, New Haven, April 5–7, 1894; and the tenth at the Teachers' College, Morningside Heights, New York city, April 25–27, 1895. The meetings of the Association have been devoted chiefly to the reading and discussion of a great variety of papers, though the fifth, seventh, ninth, and tenth meetings were signalized by interesting public expositions of gymnastics.

The Association has published the Proceedings of nine annual meetings, and the Proceedings of the Tenth Annual Meeting are about to be sent to press. The series of Annual Proceedings of the A. A. A. P. E. contain by far the most representative and complete collection of papers on physical education that have appeared in the United States during the past decade, and constitute an invaluable index of the progress of physical training during that period. The growth of the Association in respect to membership has been spasmodic. Thus the Proceedings of the Seventh Annual Meeting show a total membership of between 720 and 730, while the lists contained in the Proceedings of the Ninth Annual Meeting show a membership of not quite 640. The great

majority of the members of the Association have hitherto been residents of the Eastern and Middle States. All things considered, the maintenance of an independent existence for ten years is a notable achievement.

The work of the Association has been limited perforce, hitherto, to holding one meeting a year, and publishing the annual proceedings for the benefit of a fluctuating and widely scattered membership. The need of a closer union, of a more compact organization, and of more sustained and vigorous effort had been felt by many members of the Association prior to 1893, when three gentlemen, then and now members of the Council of the A. A. A. P. E., attended the Twenty-Sixth Gymnastic Festival of the North American Gymnastic Union (*N. A. Turnerbund*) as a special committee of observation, at the invitation of the National Executive Committee of the Gymnastic Union. The festival, which was held in Milwaukee, Wisconsin, July 21–25, 1893, was a notable affair, and afforded striking and decisive evidence of the vigor and influence of the Gymnastic Union. They saw so much to excite their admiration in the spirit and conduct of the festival, and were so impressed by the excellence and efficiency of the organization of the Turnerbund, which is a federal union of local societies, numbering 395 in 1893, that the plan of reorganizing the A. A. A. P. E., by multiplying local societies and affiliating them in a truly national association, with a central National Council in charge of the general affairs of the Association, commended itself favorably to Messrs. Hitchcock, Sargent, and Hartwell. Accordingly, at a meeting of the Council, held in Chicago, Dr. Gulick, then Secretary of the A. A. A. P. E., was requested to draft a provisional scheme of reorganization, which was submitted to the Association at its meeting in Chicago, July 29, 1893. By the Association this provisional scheme was referred to the Council for further consideration. The Council appointed a committee, consisting of Messrs. Hartwell, Gulick, and Eberhard, which reported in favor of reorganization to the Association at its meeting in New Haven. The Association accepted and adopted the report of the committee, and the Council was empowered to elaborate and perfect a plan of reorganization modelled on the organization of the N. A. Turnerbund. The matter was entrusted by the Council to a committee consisting of Dr. Hartwell, Miss Homans, and Dr. Sargent, whose report was accepted by the Association at its tenth annual meeting in New York, April 25, 1895. On April 27th the Association adopted the revised Constitution, By-Laws, and Statutes

appended to this circular, ratified the vote of the New Haven meeting whereby Boston was designated National Headquarters, extended the terms of office of the existing officers till the new National Council should be reorganized, and voted that a convention of the New England members of the A. A. A. P. E. should be held within thirty days thereafter for the purpose of electing nine members of the National Council and three substitutes. These forward steps have been taken deliberately and with consideration by the Association. The next step to be taken is for the individual members of the Association to exert themselves to increase its membership, and to extend the sphere of its usefulness by organizing local Physical Education Societies as branches of the A. A. A. P. E.

The Association numbers, and always has numbered, among its most zealous and active members workers in diverse though related fields of endeavor, *e. g.*, private and public schools of every grade, colleges, and universities. This fact and the exigencies of the situation impel the Council to adopt a broad and liberal policy which shall make for united and harmonious endeavor, within the Association, to win a more influential and dignified place for physical training in the educational and scientific order of our day. The first aim of the Council is to hasten the multiplication of local Physical Education Societies of the A. A. A. P. E., to serve as rallying points for the friends of physical education, in all parts of the country, in an aggressive campaign of education. The successful prosecution of such a campaign demands intelligence, forbearance, patience, and tenacity of purpose on the part of those who undertake to enlighten the general and educational public as to the need and value of physical education. It is indispensably necessary that we should ourselves be familiar with the teachings of science and the lessons of experience as to the nature, effects, and achievements of physical training in its leading departments of gymnastics and athletics, else we shall be insufficiently prepared to persuade or convince those who mould public opinion and control educational affairs.

In due time it will devolve upon the Council to perfect arrangements for holding the National Convention of the Association. Meanwhile, aside from encouraging and aiding the formation of local societies, its leading policy will be chiefly directed to gathering, digesting, and disseminating information primarily for the benefit of the Association, and, secondarily, for that of the public. Through its Standing Committee

on Publication and Information, the Council hopes to gather a library, and to establish a central bureau of information regarding the progress of physical education in America and Europe. So far as the means at its disposal will admit, it aims to publish and distribute reprints of papers by leading writers, past and present, condensed abstracts and critical reviews of books, notes on the progress in physical education at home and abroad, and bibliographical lists and notes relating to the current literature of physical education. To enable the Council to accomplish its purpose in these directions, close and mutually helpful relations between it and the constituent societies must be cultivated, and the funds at its disposal must be increased.

The Council therefore appeals to the officers of Physical Education Societies, and to all members of the Association as well, to send in frequent and prompt reports of progress that may come to their notice in any department of physical education; to forward to it the names of persons outside the Association to whom this circular and subsequent publications may profitably be sent; to suggest ways and means of increasing the usefulness of the Council and the Association; to contribute books, papers, articles, newspaper clippings, official reports, and memorabilia relating in any way to the history of physical education, especially in America; and to secure donations and bequests of money to aid the Council in its endeavors to disseminate information in printed form, or by means of lectures and addresses.

The Council also urges the members of the A. A. A. P. E. to make vigorous propaganda of the principles of physical training among the friends of educational reform, and among teachers, school superintendents, school boards, and other public officials, and to strive to enlist the aid of all such persons, and also of the more intelligent devotees of athletics, in bringing about the spread and improvement of systematic and effectual bodily training in the education of children and youth.

The Council appeals to the members of the Association to take speedy action towards organizing Physical Education Societies in the localities where they reside. Pending the formation of District and Section organizations, the Council will issue a certificate of membership in the American Association for the Advancement of Physical Education to any Physical Education Society, provided such society, through its president and secretary, shall satisfy the Council that the society has adopted the General Constitution and By-Laws and ratified the Statutes of the A. A. A. P. E.; shall furnish the Council with a list of its members

and officers; and shall accompany its application for membership with the entrance fee as is specified in Section 8, under Division B, of the Statutes of this Association. (See page 13.)

Until further notice, individuals living where no Physical Education Society exists may be admitted to membership in the Association by special vote of the Council on the payment of $1.00, provided their application for admission is endorsed by two members of the A. A. A. P. E. The Council will exercise its discretion in assigning such persons to membership in a Physical Training Society, or in continuing them on the roll as members at large, subject to an annual assessment of $1.00.

All members of the A. A. A. P. E., whose dues ($1.00) for 1895 shall be paid by December 20, 1895, will be entitled to receive one copy of the Proceedings of the Tenth Annual Meeting of the Association, which was held in New York April 25–27, 1895. The Council has a limited number of nearly complete sets of the Proceedings for sale. Orders or inquiries concerning back numbers of the Proceedings should be addressed to the Corresponding Secretary.

Copies of this circular may be had by applying to George W. Fitz, Corresponding Secretary National Council of the A. A. A. P. E., Cambridge, Mass. Communications may be addressed to the Corresponding Secretary, or to Edward M. Hartwell, President of National Council A. A. A. P. E., 5 Brimmer Street, Boston, Mass.

WALTER CHANNING.
CHRISTIAN EBERHARD.
GEORGE W. FITZ.
EDWARD M. HARTWELL.
EDWARD HITCHCOCK.
AMY MORRIS HOMANS.
RAY GREENE HULING.
HOPE W. NAREY.
D. A. SARGENT.

National Council of A. A. A. P. E.

BOSTON, November 15, 1895.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF PHYSICAL EDUCATION.

GENERAL CONSTITUTION.

ARTICLE I.

NAME.

This body shall be called the AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF PHYSICAL EDUCATION.

ARTICLE II.

OBJECTS.

Section 1.—The objects of this Association shall be to awaken a wider and more intelligent interest in Physical Education; to acquire and disseminate knowledge concerning it; and to labor for the improvement and extension of gymnastics, games, and athletic pastimes in the education of children and youth.

ARTICLE III.

MEMBERSHIP.

Section 1.—The membership of the societies belonging to this Association shall consist of Active, Associate, and Honorary Members.

Sec. 2.—Active membership shall be restricted to those directly engaged in physical education.

Sec. 3.—Associate Members shall include all who are interested in the cause of physical education, and desire to be associated with the Society.

Sec. 4.—Honorary Members shall not exceed the proportion of one to twenty-five Active Members, and shall consist of persons well known as patrons of physical education. They shall be nominated by the Executive Committee and require a two-thirds vote of the members present to elect.

Sec. 5.—Active and Associate Members shall pay the same dues and be entitled to the same privileges, except that the President, Secretary, and at least three other members of the Executive Committee, shall be chosen from the Active Members.

Sec. 6.—Active and Associate Members shall be proposed in open meeting of the Society, and be elected by a two-thirds vote of the members present. The Executive Committee shall determine to which class each member belongs.

ARTICLE IV.

OFFICERS.

The officers of each Society shall consist of a President, two Vice-Presidents, a Secretary, and a Treasurer, who, with three additional members, one of whom shall have served the Society as President or Vice-President, shall constitute the Executive Committee.

ARTICLE V.

STANDING COMMITTEES.

Section 1.—There shall be three Standing Committees of three members each, appointed by the Executive Committee. One member of each committee shall be appointed for a term of one year; one for two years, and one for three years. After the first year it shall be the duty of the Executive Committee to appoint one member for a term of three years at each annual meeting.

Sec. 2.—The chairman of each committee shall be the member with the shortest unexpired term of office.

Sec. 3.—The First Standing Committee shall be known as the Committee on Theory and Statistics, and shall report to the Society on publications, statistics, historical material, new methods of securing data, new lines of investigation, etc., pertinent to its department.

The Second Standing Committee shall be styled the Committee on Publication and Bibliography. It shall consider and report on matters pertaining to the history and bibliography of physical education, and take steps to secure a library which shall be under its control.

The Third Standing Committee, which shall be styled the Technical Committee, shall consider and report on all matters pertaining to the practical side of physical education, the extension of the work, new views and methods of physical training, new apparatus, buildings, appliances, etc.

Sec. 4.—Each committee shall report in writing to the Society at its annual meeting, and these reports shall be subject to the will of the Executive Committee as to publication in full or in part.

ARTICLE VI.

MEETINGS.

The regular meeting of each Society shall occur at such intervals as may be appointed by a two-thirds vote of the Society. The Executive Committee may change the time of individual meetings or call special meetings.

ARTICLE VII.

REVENUE.

Section 1.—One dollar shall be due at the annual meeting from each Active and Associate Member.

Sec. 2.—Any member neglecting to pay his annual dues for two successive years shall forfeit his membership.

Sec. 3.—Additional dues or assessments may be levied by the Executive Committee, subject to approval by the Society's two-thirds vote.

ARTICLE VIII.

QUORUM.

Nine members shall constitute a quorum in a Society to do business.

ARTICLE IX.

AMENDMENTS.

All alterations or amendments to the constitution of any Society must be presented in writing, lie over for one meeting, be advertised in the notice of that meeting, then adopted by a two-thirds vote of the members present, and be ratified by the National Council.

GENERAL BY-LAWS.

1. The President shall preside at the meetings of the Society and of the Executive Committee, and deliver an address at the annual meeting.

2. In the absence of the President the senior Vice-President shall preside.

3. The Secretary shall perform the duties usual to his office.

4. The Treasurer, as custodian of the Society's funds, shall not pay out any money except on vote of the Executive Committee, certified to by the Secretary and indorsed by the presiding officer. He shall render a report at the annual meeting, when the books shall be audited by a special committee.

5. The Executive Committee shall exercise a general oversight over the affairs of the Society; arrange programmes for the meetings, and control the expenditures of the Society. They shall make rules for their own government and pass favorably or adversely on all applications for membership.

6. All papers read before the Society shall be the property of the author of the paper, to be published where he chooses, but he shall give the Executive Committee the privilege of publishing it in the Transactions of the Society if they so desire.

7. Amendments to the by-laws shall receive the unanimous consent of the members present, or take the same course as amendments to the constitution, except that they shall be ratified by the Executive Committee of the District to which the Society belongs.

8. Each Society shall be at liberty to pass or amend special by-laws at its own discretion for the regulation of its particular affairs, so long as they do not conflict with the constitution and general by-laws above set forth.

STATUTES.

DIVISION A.— ORGANIZATION.

Sections.

1. The A. A. A. P. E. shall, until otherwise ordered by a National Convention, embrace the following Sections: —

1. The New England Section, with headquarters in Boston.

2. The New York Section, with headquarters in New York city.

3. The Middle Atlantic, including New Jersey, Pennsylvania, Maryland, District of Columbia and Virginia, with headquarters in Philadelphia.

4. The Ohio Section, including West Virginia, Ohio, Indiana, and Kentucky, with headquarters in Cincinnati.

5. The Lake Section, including Illinois and Michigan.

6. The Northwestern Section, including Wisconsin and Minnesota, with headquarters in St. Paul.

7. The Mississippi Valley Section, including Missouri, Tennessee, and Kansas, with headquarters at St. Louis.

8. The Western Section, with headquarters at Denver.

9. The Southern Section, with headquarters at New Orleans.

10. The Pacific Coast Section, with headquarters at San Francisco.

2. Each Section shall be divided into Districts, and each District into Physical Education Societies. District associations shall include all the societies in a State, unless the National Council shall decide otherwise.

OFFICERS.

3. Each Section and District, like each Society, shall each year elect (1) a President, (2) two Vice-Presidents, (3) a Secretary, (4) a Treasurer, who, with three additional members (one of whom shall have served as President or Vice-President), shall constitute the Executive Committee of their respective organizations.

4. The Standing Committees of Sections and Districts shall correspond to the Standing Committees in the Society in their name and function, and shall be chosen by the Executive Committee. Special committees shall be chosen as the organizations aforesaid may elect. The aforesaid Executive Committees shall constitute the executive body of their respective organizations, and shall have general regulation and control of such, under their own rules and by-laws, which shall conform to the constitution and statutes of the A. A. A. P. E.

The Executive Committees specified above shall be elected annually, and each officer shall be separately balloted for.

MEETINGS AND ELECTIONS.

5. Each District and Section shall hold an annual convention, whose arrangement and conduct shall be in the hands of the appropriate Executive Committee. The annual convention shall constitute the legislative body of the Districts and Sections respectively. The Societies shall be represented by delegates in the district convention, and each District shall be repre-

sented by delegates in the convention of the Section to which it belongs and in the national convention of the Association. Representation in the District and Section conventions shall be determined by such conventions as they may elect.

6. The Executive Committee of a District or Section may call extraordinary meetings or conventions at their discretion. The annual Section convention may be omitted in the year of holding a national convention of the Association by a two-thirds vote of all the District Executive Committees in the Section. In such a case the officers of the Section shall remain in office till the next ensuing convention of the Section.

7. Headquarters of Districts shall be designated by the District convention, and headquarters of Sections and national headquarters by the national convention. Pending the meeting of the next national convention they shall be designated by the national council.

NATIONAL CONVENTION.

8. The National Convention of the Association shall constitute the highest legislative body and court of appeal of the A. A. A. P. E., and the National Council shall constitute the executive body for the management of the affairs of the Association during the intervals between national conventions. Its members shall, *ex officio*, be members of the national convention, but without power to vote in the same.

9. In all matters concerning principles, or of unusually great importance in administration, the resolutions passed by the National Convention shall be submitted to a general vote of the members of the A. A. A. P. E., and shall become laws only in case a majority of all the votes cast by members approves the same.

The National Convention shall have the power to decide whether an administrative question shall be submitted to the Societies for a general vote of the members, but any question must be submitted to such a vote upon the demand of *at least* ten delegates from six different Districts.

Whenever 300 members of the Association shall demand in writing a vote on any subject,— the passage of a law, a change in or the abolition of an old law, etc.,— it shall be the duty of the National Council to immediately submit the matter to the several Societies and to call for a vote upon the subject, within six weeks from the date of the announcement therefor, and to announce the result of the vote so taken to the Societies. Only votes cast personally shall be counted between the sittings of the national convention.

COUNCIL.

10. The National Council shall appoint from its own members and substitutes four Standing Committees, viz.:

1. On Finance.
2. On Theory and Statistics.
3. On Publication and Information.
4. On Technical Affairs.

11. The National Council may appoint special committees at its discretion, but such special committees shall not serve beyond the term of office of the Council which appoints them, except by permission of the national convention.

12. The National Council, through its committees, shall designate the time for holding the national convention, and shall arrange its programme and conduct the section meetings of the same. But the President of the Council shall open the convention, which may choose its own President, Vice-Presidents, and Secretaries to act at the general meetings of the convention.

13. The National Council shall prepare, publish, and distribute the Proceedings of the National Convention, and an Annual Report of the proceedings of the Council, and the affairs of the Association. Each District shall furnish an accurate and full statistical return of the membership of its constituent societies to the National Council.

14. The Societies shall send correct statistical reports of the preceding calendar year to their several District Executive Committees before each 15th day of January, and the latter committee shall transmit the reports of all Societies to the National Council at the latest by the first day of February in each year.

15. In collecting the annual statistical reports the Corresponding Secretary of the National Council shall have the right to apply to the respective Societies directly.

16. The general constitution and by-laws of the A. A. A. P. E. shall precede all District and Society statutes, as an introduction thereto, and the District or Society statutes shall contain no clause that is contradictory to the constitution of the A. A. A. P. E.

DIVISION B.— ADMINISTRATION.

1. The National Convention of the A. A. A. P. E. shall meet at least once in four, but not oftener than once in two, years. It shall determine the place of meeting of the next convention, while the National Council shall designate the date of the meeting.

2. Whenever a number of Districts which, taken together, represent at least one-third of the total vote of the A. A. A. P. E. demand a special meeting of the National Convention of the Association, it shall be the duty of the National Council to call it. The place of the meeting shall be selected by the National Executive Committee.

Such special meetings of the National Convention shall not begin their sessions until thirty days after the publication of the call.

3. Only such delegates as possess a District credential shall be allowed a seat or vote in the National Convention. It shall be left to the Districts to determine the mode of election. No delegate shall represent more than one District.

4. Each District must be represented at the National Convention, either by delegates from the District itself or from other Districts. The Districts are entitled to the following number of delegates: —

They are entitled to one vote for thirty members; for every twenty members more, or a fraction of over twenty, to another vote. One delegate may represent all the votes of a District, but Districts which choose to be represented by delegates from other Districts shall not be entitled to elect a delegate from the District in which the National Convention is held. Delegates from Districts which are in arrears with their contributions to the A. A. A. P. E. for the fiscal year preceding the National Convention can be admitted to a seat and vote only by a resolution of the National Convention.

5. Districts not represented at the National Convention, unless they tender the National Council sufficient excuse therefor, within four weeks from the beginning of the National Convention, shall be excluded from the A. A. A. P. E. by the National Council.

6. The National Convention of the A. A. A. P. E. shall determine the District in which the National Council shall be located; the convention of such District shall elect the members of the National Council and three substitutes. An absolute majority of votes is necessary for election. The members of the National Council, whose number shall be nine, shall elect the officers of the Council from among their own number, to wit: a President, a Vice-President, a Corresponding Secretary, a Recording Secretary, and a Treasurer.

The Corresponding Secretary and the Treasurer shall receive a salary, and the National Convention shall grant to the National Council sufficient means for this purpose. The salaries shall be fixed by the National Council.

7. The District Convention of the District in which the National Council is to be located, and which is to elect the members of the same, shall meet within thirty days after the National Convention of the Association, and such District Convention shall then elect the nine members of the National Council and three substitutes; and the latter, in accordance with the respective number of votes received by each, shall be designated as first, second, and third substitutes, and shall fill vacancies in the National Council in this order. Each member and substitute shall be separately balloted for.

In case a vacancy occurs in the National Council, the latter, after having called in a substitute, shall elect a new officer out of its own number and fill any vacant office. The National Council shall remain in office until the new Council is organized.

8. Districts, upon entering the A. A. A. P. E., shall pay into the treasury of the National Council the sum of $5.00 for each Society included in the District. If the admission take place between January 1 and October 1, the fee for entrance must be paid in full. If between October 1 and January 1, one-half the entrance of $5.00 shall be remitted.

No District shall admit a Society into its organization which has not met its financial and other obligations toward the District to which it claims to belong.

9. Each District shall pay, on or before December 31 of each year, to the National Council, an annual contribution of $1.00 for each member of the several societies composing it. The raising of revenue for the Districts

and Sections, by means of entrance fees or assessments or taxes, shall be left to the Districts and Sections respectively.

10. No Society shall admit to membership any person who is in arrears to any other Society; but any member of the Association whose dues are paid, and who is in good and regular standing, shall be entitled to receive a certificate of membership, on the strength of which he may be received as a member by any other Society he may chance to enter, without paying an entrance fee.

11. These Statutes, as also the General Constitution and By-Laws, may be amended or altered by a two-thirds vote of the National Convention; or by a majority vote of the members of the Association, if the proposed amendment or alteration be submitted to the constituent Societies in accordance with Section 9 of Division A, of these Statutes.

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